



UNIVERSITY OF CALICUT

Abstract

General and Academic - Faculty of Science - Syllabus of BSc Microbiology Programme under CBCSS UG Regulations 2019 with effect from 2019 Admission onwards - Implemented- Orders Issued.

G & A - IV - J

U.O.No. 9836/2019/Admn

Dated, Calicut University.P.O, 25.07.2019

- Read:-*1. U.O.No. 4368/2019/Admn dated 23.03.2019
2. Minutes of the meeting of the Board of Studies in Microbiology held on 08.04.2019
3. Item No. I.10 in the minutes of the meeting of Faculty of Science held on 27.06.2019
4. U.O.No. 8860/2019/Admn dated 05.07.2019

ORDER

The Regulations for Choice Based Credit and Semester System for Under Graduate (UG) Curriculum-2019 (CBCSS UG Regulations 2019) for all UG Programmes under CBCSS-Regular and SDE/Private Registration w.e.f. 2019 admission has been implemented vide paper read first above .

The meeting of Board of Studies in Microbiology held on 08/04/2019 has approved the Syllabus of B Sc Microbiology Programme in tune with the new CBCSS UG Regulations with effect from 2019 Admission onwards, vide paper read second above.

The Faculty of Science at its meeting held on 27/06/2019 has approved the minutes of the meeting of the Board of Studies in Microbiology held on 08/04/2019, vide paper read third above.

Under these circumstances , considering the urgency, the Vice Chancellor has accorded sanction to implement the Scheme and Syllabus of B Sc Microbiology Programme in accordance with new CBCSS UG Regulations 2019, in the University with effect from 2019 Admission onwards, subject to ratification by the Academic Council.

The Scheme and Syllabus of BSc Microbiology Programme in accordance with CBCSS UG Regulations 2019, is therefore implemented in the University with effect from 2019 Admission onwards.

Orders are issued accordingly. (Syllabus appended). The U.O read as (4) above earlier issued in this regard stands cancelled.

Biju George K

Assistant Registrar

To

The Principals of all Affiliated Colleges

Copy to: PS to VC/PA to PVC/ PA to Registrar/PA to CE/JCE I/JCE IV/DoA/EX and EG Sections/GA I F/CHMK Library/Information Centres/SF/DF/FC

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Section Officer

UNIVERSITY OF CALICUT



**B.SC. MICROBIOLOGY
SYLLABUS**

(2019 Admission onwards)

Scheme of Evaluation for B.Sc. Microbiology CBCSS (2019 Admission Onwards)

Semester	Course nature	Course code	Course title	Hours/week	Credits	Total credits	Scheme of Evaluation (in		
							Internal (20%)	External (80%)	Total
I	Common English course I	A01		4	4	18	20	80	100
	Common English course II	A02		5	3		15	60	75
	Additional language course I	A07(3)	Communication skill in the languages other than English for B.Sc alternate pattern	5	4		20	80	100
	Core course I	MBG1B01	General Microbiology	3	3		15	60	75
	Ist Complementary	--1C01		2	2		15	60	75
	Ist Complementary - Practical	--4C08(P)		2					0
	2nd Complementary	MBG1C02	Biostatistics I	4	3		15	60	75
II	Common English course III	A03		4	4	20	20	80	100
	Common English course IV	A04		5	3		15	60	75
	Additional language course II	A09(3)	Literature in languages other than English for B.Sc. Alternate pattern	5	4		20	80	100
	Core course II	MBG2B02	Microbial Physiology and Taxonomy	3	3		15	60	75
	Ist Complementary	--2C03		2	2		15	60	75
	Ist Complementary - Practical	--4C08(P)		2	*			0	
	2 nd Complementary	MBG2C04	Biostatistics II	4	3		15	60	75
III	General course I	A11	General Course I (LRP pattern)	4	4	16	20	80	100
	General course II	A12	General Course II (LRP pattern)	4	4		20	80	100
	Core course III	MBG3B03	Environmental and Sanitation Microbiology	4	4		20	80	100
	Core practical course I	MBG4B05(P)	Microbiology Practical I	3	*				0
	Ist Complementary	--3C05		3	2		15	60	75
	Ist Complementary - Practical	--4C08(P)		2	*				0
	2 nd Complementary	MBG3C06		3	2		15	60	75
	2 nd Complementary-Practicals	MBG4C10(P)		2	*				0

Semester	Course nature	Course code	Course title	Hours/week	Credits	Total credits	Scheme of Evaluation (in		
							Internal (20%)	External (80%)	Total
IV	General course III	A13	General Course III (LRP pattern)	4	4	26	20	80	100
	General course IV	A14	General Course IV (LRP pattern)	4	4		20	80	100
	Core course IV	MBG4B04	Soil and Agricultural Microbiology	4	4		20	80	100
	Core course Practical I	MBG4B05(P)	Microbiology Practical I	3	4		20	80	100
	Ist Complementary	--4C07		3	2		15	60	75
	Ist Complementary - Practical	--4C08(P)		2	4		20	80	100
	2 nd Complementary	MBG4C09		3	2	15	60	75	
	2 nd Complementary- Practicals	MBG4C10(P)		2	2	15	60	75	
V	Core course V	MBG5B06	Industrial Microbiology	4	4	18	20	80	100
	Core course VI	MBG5B07	Food and Dairy Microbiology	4	4		20	80	100
	Core course VII	MBG5B08	Immunology	4	4		20	80	100
	Core course VIII	MBG5B09	Medical Microbiology-I	4	3		15	60	75
	Core course practical II	MBG6B12(P)	Microbiology Practical II	4	*				0
	Project work	MBG6B16 (Pr)	Project Work	3	*				0
	Open course-for other departments	MBG5D01	Open course- for other departments	2	3		15	60	75
		MBG5D02	Open course- for other departments						
MBG5D03		Open course- for other departments							
VI	Core course IX	MBG6B10	Genetics and genetic engineering	4	4	22	20	80	100
	Core course X	MBG6B11	Medical Microbiology-II	4	4		20	80	100
	Core course practical II	MBG6B12(P)	Microbiology Practical II	4	4		20	80	100
	Core course practical III	MBG6B13 (P)	Microbiology Practical III	4	3		15	60	75
	Core course practical IV	MBG6B14 (P)	Microbiology Practical IV	3	3		15	60	75
	Elective course	MBG6B15 (E1)	Cell and Tissue culture	4	2			15	60
		MBG6B15 (E2)	Molecular Biology						
		MBG6B15 (E3)	Bioinstrumentation						
Project work	MBG6B16 (Pr)	Project work (Examination along with the core practical examination)	2	2		10	40	50	
					120	120	640	2560	3200

*Credits after exam at the end of semester IV/VI, Ability enhancement courses as per the regulations is mandatory for the completion of the programme

Scheme of Evaluation for B.Sc. Microbiology CBCSS

Distribution of different courses and their credits

Semester	Course type	No.of Courses	Credits	Marks
I and II	Common-English	4	14	350
I and II	Common-Addl language	2	8	200
III and IV	General Common	4	16	400
I to IV	Complementary	11	24	775
I to VI	Core	14	53	1400
V	Open (Other dept.)	1	3	75
V through VI	Project (core)	1	2	50
Total		37	120	3200

I through IV Ability enhancement Courses 4 16

Total common courses offered	:	10
Total core courses offered in the area of specialization (Microbiology) including project work and practical	:	16
Total Complementary courses offered including practicals (two complementary subjects)	:	11
Total courses offered in 6 semesters	:	37
Total credits aquired through class room study	:	120
Total credits required for qualifying Degree	:	140
Total credits offered for core, complementary and open put together	:	82
Total credits required for common courses	:	38

General Course offered (Designed by the Board of studies)

1. General course I - IV for LRP group IV : 16 credits

Open courses offered to students of other Departments with credits (5th Semester)

1. Public health and emerging microbial diseases : 3 credits

2. Environmental Microbiology : 3 credits

Elective from the parent department with credits (6th Semester)

1. Cell and tissue culture : 4 credits

2. Molecular Biology : 4 credits

3. Bioinstrumentation : 4 credits

Complementary Courses for B.Sc. Microbiology

1st Complementary -Biochemistry : 12 Credits

2nd Complementary- Biostatistics and Computer Applications : 12 Credits

Scheme of Examination, Evaluation and Grading:

- There shall be University examinations at the end of each semester.
- Practical examinations shall be conducted by the university at the end of even semesters.
- Practical examination, project / dissertation evaluation and viva voce shall be conducted by one external examiner and one internal examiner appointed by the university.
- Project evaluation shall be conducted at the end of 6th semester.
- Each Practical examination shall be conducted in two consecutive days of six hours duration.
- Evaluation and grading are in accordance with the general guidelines given by the university.
- The questions should be answered only in English

SEMESTER III MBG3C06 Computer Applications- Fundamentals*

SEMESTER IV MBG4C09. C-Language, Data Base Management System & SQL*

 MBG4C10 (P) Computer Applications Practical II (with exam)*

*The syllabus modification of the 2nd complementary may be done by the BOS of Computer science and Statistics

CORE COURSE

MICROBIOLOGY

SEMESTER I

MBG1B01. GENERAL MICROBIOLOGY

3 Hrs /week

3 credits

- Unit 1. Scope and history of Microbiology, spontaneous generation vs. biogenesis. Contributions of the following scientists in various areas of Microbiology - Anton van Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Martinus W. Beijerinck, Sergei N. Winogradsky, Alexander Fleming, Selman A. Waksman. Beneficial and harmful microbes.
- Unit 2. Eukaryote and prokaryote - differences. Differences between archaeobacteria and eubacteria. Bacterial forms and arrangement of cells. Actinomycetes, Mold and yeast forms. Viral and bacteriophage forms.
- Unit 3. Ultrastructure of bacteria- External structures-glycocalyx, capsule, flagella, fimbriae and pili. Cell-wall: Composition and detailed structure of gram positive and gram-negative cell walls, Archaeobacterial cell wall, sphaeroplasts, protoplasts, and L-forms. Effect of penicillin and lysozyme on the cell wall. Cell Membrane: Structure, function and chemical composition of bacterial and archaeal cell membranes. Cytoplasm: Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids Endospore: Structure, formation, stages of sporulation.
- Unit 4. Microscopy- bright field, dark field, phase contrast, fluorescent and electron microscopy. Staining techniques- simple, negative, Grams, spore, flagella, acid fast, volutin, capsule and Fuelgen staining.
- Unit 5. Sterilisation and disinfection techniques- Physical and chemical methods- flaming, boiling, autoclaving, inspissation, Heat, Filtration, Radiation. Aseptic methods- laminar air flow hood. Disinfectants and its testing.

Suggested Readings

1. Fundamentals of Bacteriology by A.J Salle
2. Microbiology by Pelczar *et al*
3. Fundamentals of Microbiology by Mertus Frobisher
4. General microbiology by Stanier *et al*
5. Text book of Microbiology by Prescott.
6. Principles of Microbiology by Ronald Atlas
7. Microbiology: An Introduction by Tortora GJ, Funke BR, and Case CL.
8. Microbiology: Principles and Explorations *by Black.*
9. Brock Biology of Micro-organisms.
10. Alcamos Fundamentals of Microbiology

SEMESTER II

MBG2B02. MICROBIAL PHYSIOLOGY AND TAXONOMY

3 Hrs /week

3 credits

- Unit 1. Microbial growth: Effect of various parameters and Environmental factors on microbial growth- Temperature, pH, O₂, solute concentration and other factors. Classification based on specific requirement-based on temperature, pH, O₂ and solute concentration. Nutritional requirements of bacteria- C, electron, energy, and minerals. Nutritional types of bacteria- based on the requirement and their combinations. Modes of bacterial nutrition. Transport of nutrients by bacteria- passive, active and group translocation. symport, antiport and uniport, electrogenic and electro neutral transport, transport of Iron.
- Unit 2. Culture media-Solid and liquid media, use of agar. Selective, Enrichment, Enriched, differential, selective-differential, indicator media, Transport media, simple and complex, synthetic or defined, Anaerobic media. Culture methods-Streak, spread, pour plate methods, stab culture and lawn culture. Cultivation of aerobic and anaerobic bacteria. Culture preservation strategies.
- Unit 3. Modes of reproduction in bacteria- fission, budding, fragmentation, sporulation. Growth curve and its significance, generation time, steady state culture, synchronous culture and Diauxic culture. Quantitative measurement of bacterial growth by direct and indirect methods. Viral growth- lytic and lysogenic stage. Viral cultivation methods. Viral and bacteriophage quantitation methods- Plaque and pock assay.
- Unit 4. Basics of microbial taxonomy- concept of species and taxa and strain. Classification systems- Numerical taxonomy or Adansonian classification, phenetic and phylogenetic Classification. Various criteria used in bacterial classification:- classical, morphological, physiological, metabolic and ecological characteristics. Molecular characteristics- comparison of proteins, nucleic acid base composition, nucleic acid hybridization and nucleic acid sequencing, 16 S rRNA studies.

Suggested Readings

1. Fundamentals of Bacteriology by A.J Salle
2. Microbiology by Pelczar *et al*
3. Fundamentals of Microbiology by Mertus Frobisher
4. General microbiology by Stanier *et al*
5. Text book of Microbiology by Prescott.

6. Principles of Microbiology by Ronald Atlas
7. Microbiology: An Introduction by Tortora GJ, Funke BR, and Case CL.
8. Microbiology: Principles and Explorations by Black.
9. Brock Biology of Micro-organisms.
10. Lippincotts illustrated reviews microbiology by Harvey
11. Alcamos fundamentals of microbiology
12. Moat AG and Foster JW. (2002). *Microbial Physiology*. 4th edition. John Wiley & Sons.
13. Reddy SR and Reddy SM. (2005). *Microbial Physiology*. Scientific Publishers India.

SEMESTER III

MBG3B03. ENVIRONMENTAL AND SANITATION MICROBIOLOGY

4 Hrs /week

4 credits

- Unit 1. Microbiology of air - atmospheric layers, organisms in air, distribution and sources. Disease forecasting in plants. Indoor and outdoor air. Droplet nuclei, aerosol, infectious dust. Microbiological sampling of air - gravity slide, plate exposure, vertical cylinder, Hirst spore trap, Rotorod sampler, Andersen sampler, hand held air sampler, impingers and filtration. Advantages and disadvantages of these techniques. Brief account of air borne transmission of harmful microbes and air borne infections.
- Unit 2. Aquatic Microbiology: Aquatic environment, distribution of microorganisms in aquatic environment - fresh water, estuarine and marine water systems. Factors influencing growth and distributions. Water Purification procedures for single dwelling and municipal water supplies, Concept of indicator organisms, Microbiological examination of water. BOD, COD, Waste water treatment steps and methods. Eutrophication and algal bloom. Brief account of water borne diseases and transmission.
- Unit 3. Solid waste management: Sources and types of solid waste, need for management, Landfills, composting, vermi- composting, anaerobic digesters, methanogenesis and production of biogas. Design and management of biogas plant.
- Unit 4. Xenobiotic metabolism - Novel pollutants, persistence and biomagnification, Recalcitrant halocarbons- nitroaromatic compounds, PCB, alkyl benzyl sulphonates, and petroleum hydrocarbons - their biodegradation. Bioremediation of polluted environment - Oil spills, heavy Metals and other xenobiotics. Microbial leaching and corrosion of metals.

Suggested Readings

1. Microbial Ecology by Ronald M. Atlas, Richard Bartha.
2. Microbiology concepts and applications by Pelzar *et al*
3. Microbiology by Prescott.
4. Fundamentals of Microbiology by Mertus Frobisher.
5. A Hand book of water and waste water microbiology by Mara and Niger Horan.
6. Microbiological Examination Methods of Food And Water By Silva

7. Text book of Biotechnology by BD Singh
8. Text book of Microbiology by Chakrabarthy
9. Microbial Ecology. John Wiley & Sons.
10. Campbell RE. (1983). *Microbial Ecology*. Blackwell Scientific Publication, Oxford, England.
11. Maier RM, Pepper IL and Gerba CP. (2009). *Environmental Microbiology*. 2nd edition, Academic Press.
12. Stolp H. (1988). *Microbial Ecology: Organisms Habitats Activities*. Cambridge University Press, Cambridge, England.

SEMESTER IV

MBG4B04. SOIL AND AGRICULTURAL MICROBIOLOGY

Hrs /week 4

4 credits

- Unit 1. Introduction to soil Microbiology - Properties of soil (structure, texture, formation). Types of soil microbes, role of microorganisms in soil fertility; Factors affecting microbial population - moisture, pH, temperature, organic matter, agronomic practices etc.; Soil fertility test.
- Unit 2. Biogeochemical cycle- Role of microorganisms in Carbon, Phosphorous, Nitrogen and sulfur cycles. Humus formation and its significance.
- Unit 3. Biological Interactions - Microbe-Microbe Interactions. Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation. Microbe-Plant Interactions. Roots- Rhizosphere and *Mycorrhizae*, Aerial Plant surfaces, Microbe-Animal Interactions. Role of Microbes in Ruminants, Nematophagus fungi, Luminescent bacteria as Symbiont
- Unit 4. Plant pathology (symptoms, disease cycle and control measures) - Bacterial diseases - Angular leaf spot of cotton, bacterial leaf blight of rice, crown galls, bacterial cankers of citrus Fungal disease- Wilt of tomato -*Fusariumoxysporum* Red rot of sugarcane – *Colletotrichumfalcatum*, Early blight of potato –*Alternariasolani*, Wilt of cotton, Viral diseases- Papaya ring spot, tomato yellow leaf curl, banana bunchy top.
- Unit 5. Applications of microbes in agriculture :Biofertilizers. Symbiotic nitrogen fixation - (Rhizobium, Frankia) -Symbiotic nutrient mobilizers - Endomycorrhizae and Ectomycorrhizae. Non symbiotic microbes - Azotobacte. Associative Symbiosis - Azospirillum. Cyanobacteria (Nostoc. Gloeocapsa), Azolla-Anabaena System Bio pesticides- bacterial, fungal and viral, Advantages over the chemical counter parts. Effect of pesticides on soil microflora.

Suggested Readings

1. Microbial Ecology. John Wiley & Sons, Inc., New York 2.
2. Introduction to Soil Microbiology by Alexander, M.(1977). John Wiley & Sons, Inc.,
3. Agricultural microbiology, 2nd edition. Rangaswami G., Bagyaraj D. J. Prentice hall of India.
4. Ronald M. Atlas., Richard Bartha. Microbial Ecology. Benjamin Cummings. 1998

5. Robert, L Tate (1995). Soil Microbiology. First edition, John Wiley and Sons, Inc. New York edition. Pearson Education.
6. Rangaswami G and Mahadevan A (2002). Disease of Crop Plants in India. Fourth edition, PHI Learning (P) Ltd., New Delhi.
7. Subba Rao NS (2004). Soil Microbiology. Fourth edition, Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi.
8. Mishra RR (2004). Soil Microbiology. First edition, CBS Publishers and distributors, New Delhi.
9. Devlin RM. (1975). *Plant Physiology*. 3rd edition, Willard Grant Press.
10. Stolp H. (1988). Microbial Ecology: Organisms Habitats Activities. *Cambridge University Press*, Cambridge, England.
11. Agrios GN. (2006). *Plant Pathology*. 5th edition. Academic press, San Diego,
12. Lucas JA. (1998). *Plant Pathology and Plant Pathogens*. 3rd edition. Blackwell Science, Oxford.
13. Mehrotra RS. (1994). *Plant Pathology*. Tata McGraw-Hill Limited.
14. Rangaswami G. (2005). *Diseases of Crop Plants in India*. 4th edition. Prentice Hall of India Pvt. Ltd., New Delhi.
15. Singh RS. (1998). *Plant Diseases Management*. 7th edition. Oxford & IBH, New Delhi.
16. Raina M.Maier. Ian L.Pepper and Charles P.Gerba. (2000)Environmental Microbiology.Academic press California.UK

MBG4B05(P). MICROBIOLOGY PRACTICAL I

Hrs /week 3

Credit 4

1. Introduction to common methods of sterilization and laboratory instruments.
2. Microscope and its maintenance.
3. Simple Staining.
4. Grams staining.
5. Capsule Staining.
6. Spore Staining.
7. Volutin granule staining.
8. Preparation of media (Nutrient broth, Nutrient agar, Blood agar, Chocolate agar, Mc Conkey agar, EMB agar).

9. Motility determination - Hanging drop method, Semisolid agar method
10. Isolation of pure culture by streaking.
11. Enumeration of microbial cells (pour plate and spread plate method).
12. Fungal staining.
13. Fungal culturing.
14. Determination of phenol coefficient.
15. Oligodynamic action of heavy metals on microbes.
16. Effect of temperature on growth of microorganisms.
17. Influence of pH on growth.
18. Bacterial growth curve.
19. Isolation of bacteriophages from sewage.
20. Determination of BOD of water.
21. Air sampling by open plate method.
22. Water quality analysis-preliminary (MPN), confirmed and completed test
23. Isolation of rhizobium and azotobacter.
24. Amonification and nitrification of organic compounds.
25. Demonstration of pigment production on nutrient agar medium (*Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Serratia* species).

SEMESTER V

MBG5B06. INDUSTRIAL MICROBIOLOGY

4 Hrs/Week

4 Credits

Unit 1. Basic Concepts of Fermentations :- Fermentor - Components, Types of fermentors- Batch, Fed- batch, Continuous, liquid state , Solid State fermentors. Control systems in fermentation - sterilization, pH, Temperature, Oxygen and aeration, agitation, foam. Computer applications in fermentation technology.

Unit 2. Industrially important microorganisms - Screening Techniques- Primary and Secondary - Preservation of cultures - Strain improvement- Development of inoculum for various fermentation processes. Media formulations - Water, carbon and nitrogen source, growth factors, precursors, minerals, buffers, aeration, antifoam agents, inhibitors, precursors and inducers.

Unit 3. Downstream processing- Extraction and purification of intracellular and extra cellular products.

Unit 4. Microbial production of Wine, Ethanol. Acetone/ butanol by Clostridium species. Organic acids - Citric acid and Lactic acid, Acetic acid. Enzyme - Alpha amylase by bacteria and fungus. Vitamin B12 by streptomycessp, Antibiotics - Penicillin. Steroid transformations.

Unit 5. Introduction to intellectual property and intellectual property rights - types: patents, copy rights, trade marks, design rights, geographical indications - importance of IPR - patentable and non patentables - patenting life - legal protection of biotechnological inventions - world intellectual property rights organization (WIPO).

Suggested Readings

1. Industrial Microbiology by Prescott and Dunns.
2. Principles of Fermentation Technology. Manual of Industrial Microbiology and Biotechnology by Demain and Devis.
3. Principles of Fermentation Technology by Stanburry and Whitaker
4. Crueger W and Crueger A. (2000). *Biotechnology: A textbook of Industrial Microbiology*. 2nd edition. Panima Publishing Co. New Delhi.
5. Comprehensive Biotechnology by Murray and Moo Yung.
6. Sivakumar PK, Joe MM and Sukesh K (2010). An introduction to Industrial Microbiology. First edition, S.Chand& Company Ltd, New Delhi.
7. Agrawal AK and Pradeep Parihar (2006). Industrial Microbiology. Student edition, Jodhpur.
8. Patel AH (2005). Industrial Microbiology. Published by Mac Millan India Ltd., Chennai

9. Stanbury PF, Whitaker A and Hall SJ (1997). Principles of Fermentation Technology. Second edition, Pergamon Press.
10. LE Cassida JR (2005). Industrial Microbiology. New Age International (P) Ltd., New Delhi.

MBG5B07. FOOD AND DAIRY MICROBIOLOGY

4 Hrs/Week

4 Credits

- Unit 1. Food as a substrate for microorganisms. Types of microorganisms in food - Source of contamination - Factors influencing microbial growth in foods (extrinsic and intrinsic) Microbial examination of food- viable colony count, examination of fecal Streptococci.
- Unit 2. Physical and chemical properties of milk. Milk as a substrate for microorganisms. Types of microorganisms in Milk- bacteria, fungi and yeast. Sources of microbial contamination of milk. Microbiological analysis of milk. Rapid platform tests- organoleptic, Clot on boiling (COB), turntable acidity alcohol test, DMC, sedimentation test and pH. Standard plate count, MBRT.
- Unit 3. Food fermentations: Cheese, bread, yoghurt, idli, fermented pickles and fermented vegetables, Ice cream, - methods and organisms used. SCP, Probiotics and prebiotics.
- Unit 4. General principles underlying spoilage, different kinds of foods, cereals and cereal products - sugar and sugar products - vegetable and fruits - meat and meat products - fish and other sea foods - eggs and poultry - dairy and fermentative products (ice cream/milk/bread/wine).
- Unit 5. Food Poisoning : food borne infections (a) Bacterial: Staphylococcal, Brucella, Bacillus, Clostridium, Escherichia, Salmonella (b) Fungal : Mycotoxins including aflatoxins, ergotism (c) Viral: Hepatitis, (d) Protozoa - Amoebiasis.
- Unit 6. Food preservation : Principles of food preservation - methods of preservation. a. Physical (irradiation, drying, heat processing, pasteurization, chilling and freezing, high pressure and modification of atmosphere) b. Chemical (Sodium benzoate Class I & II). Food Sanitation: Good manufacturing practices - HACCP, Personnel hygiene.

Suggested Readings

1. Food Microbiology by Adams, MR. and Moss, M.O.1995.The Royal Society of Chemistry, Cambridge.
2. Food Microbiology by Frazier, W.C. and Westhoff, D.C.1988.TATA McGraw HillPublishing company ltd., New Delhi.
3. Modern Food Microbiology by Jay, J.M.1987.CBS Publishers and distributors, New Delhi.
4. Basic Food Microbiology by Banwart, G.J.1989.Chapman & Hall New York.
5. A Modern Introduction to Food Microbiology by Board, R.C.1983.Blackwell Scientific Publications, Oxford.

6. Dairy Microbiology by Robinson, R.K.1990. Elsevier Applied Science, London.
7. Food Poisoning and Food Hygiene, Hobbs, B.C. and Roberts, D.1993. Edward Arnold.
8. MICROBIOLOGICAL EXAMINATION METHODS OF FOOD AND WATER by SILVA
9. Lund BM, Baird Parker AC, and Gould GW. (2000). *The Microbiological Safety and Quality of Foods*. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
10. Gould GW. (1995). *New Methods of Food Preservation*. Blackie Academic and Professional, London.

MBG5B08. IMMUNOLOGY

4 Hrs/week

4 Credits

- Unit 1. Brief History of Immunology: Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff. Structure and function of the lymphoreticular system- composition of blood and lymph and their immunological properties.
- Unit 2. Immune Cells and Organs Structure, Functions and Properties of: Immune Cells - Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs - Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT
- Unit 3. Concept of innate, acquired immunity, Humoral and cell-mediated, natural and artificial immunity. Brief descriptions on mechanisms of innate immunological barriers- phagocytosis and inflammation.
- Unit 4. Antigens - features. Hapten, complete antigen, adjuvants, epitope (antigenic determinants). Factors influencing antigenicity. T dependent and T independent antigens. Role of MHC in antigen presentation- class I and class II, MHC Restriction.
- Unit 5. Basic structure of immunoglobulin - Ig G - Different classes of immunoglobulins and their function. Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic). Clonal selection theory. Production of Polyclonal & Monoclonal antibodies & their application. Hybridoma technology. Complement system- activation and functions.
- Unit 6. Antigen and Antibody Reactions-Agglutination, Precipitation, Complement fixation test, neutralization, opsonization, Gel diffusion techniques, Immunoelectrophoresis, labeled antibodies -RIA, ELISA, Western blotting, Immunofluorescent techniques.
- Unit 7. Hypersensitivity - different types -immediate and delayed - Anaphylaxis, immune complex diseases. Autoimmune diseases - mechanisms and classification. Transplantation immunology- mechanism of graft rejection.
- Unit 8. Development and Causes of Cancer, Tumor Viruses, Oncogenes, Tumor Suppressor genes, Tumor antigens, immune responses to tumors, Cancer Treatment-immunotherapy and molecular approach.

Suggested Readings

1. Abbas AK, Lichtman AH, Pillai S. (2007). *Cellular and Molecular Immunology*. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). *Roitt's Essential Immunology*. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). *Kuby's Immunology*. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). *Janeway's Immunobiology*. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). *Basic and Clinical Immunology*. 2nd edition Churchill Livingstone Publishers, Edinburgh.
6. Richard C and Geiffrey S. (2009). *Immunology*. 6th edition. Wiley Blackwell Publication.
7. Immunology by Coleman et al
8. Fundamental Immunology by Paul W.E. et al
9. Introduction to Immunology John W Kimbal et al
10. Text Book of Microbiology by Ananthanarayanan and Jayaram Panikkar.
11. Immunology by Coleman et al
12. Introduction to Immunology John W Kimbal et al

MBG5B09. MEDICAL MICROBIOLOGY I

Hrs/Week 4

3 Credits

- Unit 1. Infection and disease-definition. Types of infections. Various sources of Infection. Methods of transmission of infections. Factors influencing the virulence of pathogens. Definitions of MID, ID₅₀, MLD, LD₅₀, bacteremia, Septicemia, contagious epidemic, endemic, pandemic, sporadic and prosodesmic diseases. Epizootic and enzootic.
- Unit 2. Collection and transport of clinical specimens for microbiological examinations
Normal flora of human body.
- Unit 3. Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - *Staphylococcus aureus*, *S.pneumoniae*, *Neisseria gonorrhoeae*.
- Unit 4. Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - *Mycobacterium tuberculosis*, *Corynebacterium diphtheriae*, *Clostridium tetani*, *Bacillus anthracis*.
- Unit 5. Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - *Salmonella typhi*, *Vibrio cholerae*, *Escherichia coli*,

Pseudomonas aeruginosa

Unit 6. Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - *Treponema pallidum*, *Leptospira interrogans*, ., Rickettsial infections.

Suggested Readings

1. Ananthanarayan R and Paniker CKJ. (2005). *Textbook of Microbiology*. 7th edition (edited by Paniker CKJ). University Press Publication.
2. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). *Jawetz, Melnick and Adelberg's Medical Microbiology*. 24th edition. McGraw Hill Publication.
3. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). *Mims' Medical Microbiology*. 4th edition. Elsevier.
4. Joklik WK, Willett HP and Amos DB (1995). *Zinsser Microbiology*. 19th edition. Appleton- Century-Crofts publication.
5. Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.
6. *Medical Microbiology* : David Greenwood, Slack, Peutherer
7. Satish Gupte (2005). *The Short Textbook of Medical Microbiology*. Eighth edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.
8. Baron EJ, Peterson LR and Finegold SM (1994). *Bailey and Scotts diagnostic Microbiology*. 9th edition, Mosby publications.
9. Rajan S (2009). *Medical Microbiology*. First edition, MJP Publishers, Chennai.
10. Rajesh Bhatia and Ratan Lal Ichhpujani (2004). *Essentials of Medical Microbiology*. Third edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
11. *Medical Microbiology* by Macie and McCartney

SEMESTER VI

MBG6B10. GENETICS AND GENETIC ENGINEERING

4 Hrs/week

4 Credits

- Unit 1. Mendelian Genetics and its Extension: Principles of Inheritance, Chromosome theory of inheritance, Laws of Probability, Pedigree analysis, Incomplete and co dominance, Aneuploidy and Polyploidy, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Environmental effects on phenotypic expression, sex linked inheritance. Extra chromosomal inheritance.
- Unit 2. Linkage, Crossing Over gene transfer and Chromosomal Mapping: Linkage and crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence. Gene transfer techniques in prokaryotes and its utility in gene mapping- conjugation, transformation, transduction, interrupted mating techniques.
- Unit 3. Cell cycle and its regulation. Mitosis and meiosis. Check points and its significance. Programmed Cell death.
- Unit 4. A concise account of methods used in "Recombinant DNA" technology - brief account of cell disruption techniques, Enzymes involved in genetic engineering, vectors, gene transfer techniques, separation techniques and screening strategies.
- Unit 5. DNA Sequencing. DNA Amplification- PCR, applications of PCR. Blotting techniques, DNA (Gene) libraries, application of genetic engineering technology- Gene therapy. GM foods, modified plant and animal varieties, terminator gene technology. Ethical problems associated with the use of r DNA technology.

Suggested Readings

1. Molecular Biology of the Gene by Watson, JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AAM, 1987. The Benjamin/Cummings publishing company.
2. Genes V by Lewin B, 1994. Oxford University press.
3. Molecular Cell Biology by Lodish, H, Baltimore D, Berk A, Zipursky SL, Matsudaira P, Darnell J., 1995. Scientific American Books.
4. Molecular Biology by Freifelder D., 1991 Narosa Publishing Home.
5. Principles of Gene Manipulation, 4th Ed., by R.S.Old and S.B.Primrose. 1989.Blackwell Scientific Publications, London.
6. Biochemistry by Stryer L.,1995. W.H. Freeman and company.
7. Principles of Genetics by Gardner EJ, Simmons MJ, Snustad DP, 1991. John Wiley& Sons.

8. Genes and Genomes by Singer M, Berg P.,1991 University Science Books.
9. Alcamo IE. (2001). *DNA Technology: The Awesome Skill*. 2nd edition. Elsevier Academic Press, Brown TA. (2006). *Gene Cloning and DNA Analysis*. 5th edition. Blackwell Publishing, Oxford,
10. Clark DP and Pazdernik NJ. (2009). *Biotechnology-Appling the Genetic Revolution*. Elsevier Academic Press, USA.
11. Glick BR and Pasternak JJ. (2003). *Molecular Biotechnology*. 3rd edition. ASM Press Washington D.C.
12. Nigam A and Ayyagari A. (2007). *Lab Manual in Biochemistry, Immunology and Biotechnology*. Tata McGraw Hill, India.
13. Primrose SB and Twyman RM. (2006). *Principles of Gene Manipulation and Genomics*, 7thedition. Blackwell Publishing, Oxford, U.K.
14. Sambrook J, Fritsch EF and Maniatis T. (2001). *Molecular Cloning-A Laboratory Manual*. 3rd edition. Cold Spring Harbor Laboratory Press.
15. Willey JM, Sherwood LM, and Woolverton CJ. (2008) *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.
16. Text book of biochemistry by Satyanarayana
17. Text book of Biochemistry by DM. Vasudeven BT 408:

MBG6B11. MEDICAL MICROBIOLOGY II

4 Hrs/Week

4 Credits

- Unit 1. Viral diseases (with reference to symptoms, pathogenesis, *transmission*, prophylaxis and control) Polio, Chicken pox, Hepatitis, Rabies, Influenza, AIDS , with brief description of bird and swine flu, Dengue. An overview of emerging viral diseases: Japanese Encephalitis, SARS, Chikungunya.
- Unit 2. Fungal diseases - brief account on superficial, subcutaneous and deep mycoses (systemic), opportunistic mycoses, Laboratory diagnosis of fungal infections.
- Unit 3. Protozoan diseases - amoebiasis and malaria. Helminth infections - Tapeworm - *Taenia solium* and *Taenia saginata*, Hook worm - *Ancylostoma duodenale*, Round worm - *Ascaris lumbricoides* and filariasis - *Wuchereria bancrofti*. Flagellates *Trypanosoma brucei gambiense*, *Giardia lamblia* Laboratory diagnosis of parasitic infections.
- Unit 4. Immunoprophylaxis - vaccines - history and development. Different types - live, killed, subUnit, toxoids, bacterial, viral etc. Different routes of administration - oral and parenteral - advantages and disadvantages (eg: BCG, OPV & IPV, DPT, MMR, TAB - brief account).
- Unit 5. Antibiotics: Classification of antibiotics, mode of actions. Introduction to various

generations of antibiotics, emergence and mechanism of resistance.

Suggested Readings

1. Ananthanarayan R and Paniker CKJ. (2005). *Textbook of Microbiology*. 7th edition (edited by Paniker CKJ). University Press Publication.
2. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). *Jawetz, Melnick and Adelberg's Medical Microbiology*. 24th edition. McGraw Hill Publication.
3. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). *Mims' Medical Microbiology*. 4th edition. Elsevier.
4. Joklik WK, Willett HP and Amos DB (1995). *Zinsser Microbiology*. 19th edition. Appleton- Century-Crofts publication.
5. Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.
6. *Medical Microbiology* : David Greenwood, Slack, Peutherer
7. Satish Gupte (2005). *The Short Textbook of Medical Microbiology*. Eighth edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.
8. Baron EJ, Peterson LR and Finegold SM (1994). *Bailey and Scotts diagnostic Microbiology*. 9th edition, Mosby publications.
9. Rajan S (2009). *Medical Microbiology*. First edition, MJP Publishers, Chennai.
10. Rajesh Bhatia and Ratan Lal Ichhpujani (2004). *Essentials of Medical Microbiology*. Third edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
11. *Medical Microbiology* by Macie and McCartney.
12. *Viral Ecology* By Hurs

MBG6B12 (P). MICROBIOLOGY PRACTICAL II

Hrs/week 4

Credits 4

1. Biochemical reactions for identification of various groups of bacteria.
2. Identification of bacterial isolates from clinical samples.
3. Antibiotic sensitivity test.
4. Differential count of leukocytes.
5. Lymphocyte isolation.
6. Blood grouping.
7. WIDAL agglutination test.
8. ASO latex agglutination test.
9. RA latex agglutination test.

10. RPR test.

MBG6B13 (P). MICROBIOLOGY PRACTICAL III

Hrs/week 4

Credits 3

1. Preparation of buffers
2. Demonstration of mitosis.
3. Isolation of genomic DNA from *E.coli*.
4. Estimation of DNA.
5. Isolation of RNA.
6. Estimation of RNA.
7. β -galactosidase induction.
8. Conjugation
9. Transformation
10. Agarose gel electrophoresis of DNA
11. Restriction digestion of DNA

MBG6B14 (P). MICROBIOLOGY PRACTICAL IV

3 Hrs/week

3 Credits

1. Differences in abrupt and gradual scale up of inoculum.
2. Enrichment of coir pith degraders.
3. Sterilization problems with suspended solids in media.
4. Demonstration of SSF, fixed bed and fluidized bed systems.
5. Pellicle formation.
6. Cell disruption techniques.
7. Salting out.
8. Production of alcohol from fruit juice.
9. Microbiological assay of penicillin.
10. Production of citric acid using *Aspergillus*.
11. Isolation and screening of industrially important microorganisms from soil/environment - cellulose digesting, amylase producing.
12. Aerobic mesophilic count of milk.
13. Isolation of microbial flora of fermented milk.
14. Production of wine.
15. Methylene blue reduction test.

MBG6B15 (E1). CELL AND TISSUE CULTURE**4 Hrs/Week****2 Credits**

- Unit 1. Laboratory cultivation of plant and animal cells and tissue culture. Application of plant and animal cell and tissue culture. Basic laboratory requirements, Maintenance of sterile condition Explant selection, sterilization and inoculation
- Unit 2. Different types of culture, Callus culture, Suspension culture, Primary cell culture, Attach dependent cells attach independent cells, Cell lines, Organ culture, Types of media used and its formulations. Role of hormones, Hormones: Auxins, cytokinins, Gibberellins, Abscisic Acid, ethylene. Different media used for plant cell.
- Unit 3. Plant regeneration: organogenesis. Somatic embryogenesis; somaclonal variation, its genetic basis and application in crop improvement. Clonal propagation, production of pathogen - free virus free plants. Plant regeneration Androgenesis; Anther and pollen culture.
- Unit 4. Production of seedless plants, synthetic seeds, Production of secondary metabolites from plant cell suspension culture. Protoplast technology: isolation, culture and plant regeneration, protoplast fusion, identification and characterization of somatic hybrids, applications of protoplast technology. Specific gene transfer: indirect and direct methods.
- Unit 5. Animal cell culture as a substitute for animal experiments. Testing the viability of cells, dye exclusion methods, stem-cell culture and its applications, cell markers characterising stem cells.

Suggested Readings

1. Culture of animal cells - R.Ian Freshney 4th edition John Wiley and Sons.
2. Genetic engineering, Molecular biology and tissue culture of crop pest and disease management - P.Vidhyasekaran, Paya Publication.
3. Animal cell reactors – Chesters Ho & Daneil IC Wang- Butter worth Heinemann.
4. Plant Molecular Biology 2nd Ed: D. Grierson, S.N. Covey. Chapman & Hall.

MBG6B15 (E2). MOLECULAR BIOLOGY**4 Hrs/Week****2 Credits**

- Unit 1. DNA: DNA as the genetic material, Experimental proof. Structure of DNA and RNA, Types and forms – DNA, t-RNA, r-RNA, m-RNA - Definition and functions. Organization of bacterial and eukaryotic chromosomes. Histones and their function.

Denaturation and renaturation, cot curves. DNA topology - linking number, topoisomerases.

Unit 2. Replication of Prokaryotic and eukaryotic DNA. Semiconservative replication of DNA. Models of replication- D-Loop, rolling circle and theta model. Mutations :Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy. Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations, Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations-Ames test, Replica plating. Concept of Luria Delbrukii experiment. General DNA repair mechanisms.

Unit 3. Transcription- prokaryotic and eukaryotic. Post transcriptional modifications. Translation- prokaryotes and eukaryotes, Genetic code. Post translational modifications. Brief account of gene regulation in prokaryotes – operon concept – lac and trp operon.

Suggested Readings

1. Text book of Biochemistry by Lehninger
2. Biochemistry by Stryer
3. Molecular Biology of the Gene by Watson, JD, Hopkins NH, Roberts JW, Steitz JA,
4. Weiner AAM, 1987. The Benjamin/Cummings publishing company.
5. Genes V by Lewin B, 1994. Oxford University press.
6. Molecular Cell Biology by Lodish, H, Baltimore D, Berk A, Zipursky SL, Matsudaira P,
7. Darnell J., 1995. Scientific American Books.
8. Molecular Biology by Freifelder D., 1991 Narosa Publishing Home.
9. Principles of Gene Manipulation, 4th Ed., by R.S.Old and S.B.Primrose. 1989. Blackwell Scientific Publications, London
10. Cell biology by Karp

MBG6B15 (E3). BIOINSTRUMENTATION

4 Hrs/Week

2 Credits

Unit 1. Centrifugation: principle, types, preparative, analytical and ultracentrifuge. Electrochemical techniques: Principles of electrochemical techniques, redox reactions, the pH electrode, Biosensors.

Unit 2. Spectroscopic techniques: Properties of electromagnetic radiation, instrumentation and applications of UV and Visible spectroscopy, Spectrofluorimetry, atomic spectroscopy, NMR spectroscopic, MALDI-TOF, turbidometry and nephelometry

Unit 3. Chromatographic techniques: Principles, instrumentation and applications of different types of chromatography, HPLC, HPTLC, FPLC, GC-MS, LC-MS, Spectrophotometry: visible and UV spectrophotometry.

Unit 4. Electrophoresis: Principles, instrumentation and applications of different types of electrophoretic techniques, (gel, agarose, SDS-PAGE, pulse field) Isoelectric focusing.

Unit 5. Radio isotope techniques: The nature of radioactivity, types and rate of radioactive decay, detection and measurement of radioactivity, principle, instrumentation and applications of Geiger Muller counter, solid and Liquid Scintillation counter- autoradiography, Flowcytometry

Suggested Readings

1. Keith Wilson and John Walker. Practical Biochemistry- principles and techniques; Cambridge University press, London, UK. 2.
2. David T Plummer, Tata McGraw- Hill publishing company limited; McGraw office, New Delhi
3. C.R. Kothari, 2 nd Edition, 2004. Research methodology- methods and techniques. New Age International (P) limited publishers, New Delhi.
4. Instrumental methods of chemical analysis - P.K. Sharma
5. Biophysical chemistry - Upadhyay., Upadhyay and Nath 6. A Biologist's guide to principle and techniques of practical biochemistry - Brigian L. Williams.
6. Handbook of Biomedical Instrumentation - R.S. Khandpur, Tata McGraw Hill

COMPLEMENTARY COURSE

**BIOSTATISTICS AND COMPUTER
APPLICATIONS**

SEMESTER I

MBG1C02

Biostatistics I SEMESTER II

MBG4C04 Biostatistics

II SEMESTER III

MBG3C06 Computer Applications- Fundamentals

SEMESTER IV

MBG4C09. C-Language, Data Base Management System & SQL.

MBG4C10 (P) Computer Applications Practical II (with exam)

SEMESTER I

MBG1C02. BIOSTATISTICS

4 Hrs/Week

– I

3 credits

Unit 1. Scope of biostatistics – Types of Biological data – Data on Ratio scale – data on interval scale – data on ordinal scale – continuous and discrete data – accuracy and precision. Frequency distribution for a data – Histogram – Frequency Polygon – Cumulative frequency distributions – Ogives. Population and sample – Random sampling – Parameter and Statistics.

Unit 2. Measures of Central Tendency and Measures of Dispersion – Arithmetic mean, Median, Mode, Geometric mean. Range, Mean deviation, Variance, Standard deviation, Quartile deviation, semi interquartile range, coefficient of variation, indices of diversity.

Unit 3. Probability – Random experiment, sample space, events. Probability of events – mathematical definition – addition theorem and multiplication theorem (No proof expected, only problem solving).

Unit 4. Probability distributions. Bernoulli's distribution, Binomial distribution, Poisson distribution, and normal distribution. Parameters of these distributions, mean and variance (no derivations expected). Fitting of these distributions to real data sets.

Unit 5. Distributions derived from normal distribution – t-distribution, chi-square distribution, and F-distributions and their applications.

Reference Books

1. Zar, J. H. Biostatistical Analysis, Fourth Edition (1999), Pearson Education Inc.
2. Gupta and Kapur. Introduction to Mathematical statistics, Sulthan Chand Publications, New-Delhi.

SEMESTER II

MBG2C04. BIOSTATISTICS

4 Hrs/Week

II

3 credits

Unit 1. **Testing of hypotheses:** Statistical hypothesis – Null hypothesis – alternative hypothesis – simple and composite hypothesis. Type I and Type II error. General test procedure - Tests for goodness of fit – contingency table – tests for independence of attributes.

Unit 2. **Analysis of Variance :** One – way and two –way classified data – their mathematical model – analysis of variance – significance testing

Unit 3. **Regression Analysis:** simple linear regression – regression equations –regression coefficients – prediction values of Y – testing the significance of regression – confidence interval in regression - Analysis of variance.

Unit 4. **Simple Correlation:** Simple correlation – calculation of simple correlation from raw data – calculation of correlation from regression coefficients - Testing the presence of correlation - Applications of correlation - Spearman’s Rank correlation.

Unit 5. **Partial and Multiple correlations:** The concept of partial and multiple correlations - its applications. Calculating partial correlation of order one from simple correlations.

Reference Books

1. Zar, J. H. Biostatistical Analysis, Fourth Edition (1999), Pearson Education Inc.
2. Gupta and Kapur. Introduction to Mathematical statistics, Sulthan Chand Publications, New-Delhi.

COMPLEMENTARY COURSE

MICROBIOLOGY

Scheme for B.Sc. Microbiology Complementary Course (CBCSS)- 2019 Admission Onwards

Semester	Course code	Course title	Hours/ week	Credits	Total credits	Scheme of Evaluation (in marks)		
						Internal (20%)	External (80%)	Total
I	MBG1C01	General Microbiology	2	2	2	15	60	75
	MBG4C05 (P)	Microbiology Practical	2					
II	MBG2C02	Applied Microbiology	2	2	2	15	60	75
	MBG4C05 (P)	Microbiology Practical	2					
III	MBG3C03	Food And Industrial Microbiology	3	2	2	15	60	75
	MBG4C05 (P)	Microbiology Practical	2					
IV	MBG4C04	Immunology And Medical Microbiology	3	2	2	15	60	75
	MBG4C05 (P)	Microbiology Practical	2	4	4	20	80	100

SEMESTER 1

MBG1C01. GENERAL MICROBIOLOGY

2hrs/week

Credit 2

- Unit 1. Scope and history of Microbiology, spontaneous generation vs. biogenesis. Contributions of the following scientists in various areas of Microbiology - Anton van Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming, Selman A. Waksman. Beneficial and harmful microbes.
- Unit 2. Ultrastructure of bacteria- External structures-glycocalyx, capsule, flagella, fimbriae and pili. Cell-wall: Composition and detailed structure of gram positive and gram-negative cell walls, Archaeobacterial cell wall, sphaeroplasts, protoplasts, and L-forms. Effect of penicillin and lysozyme on the cell wall. Cell Membrane: Structure, function and chemical composition of bacterial and archaeal cell membranes. Cytoplasm: Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids Endospore: Structure, formation, stages of sporulation.
- Unit 3. Microscopy- bright field, dark field, phase contrast, fluorescent and electron microscopy-SEM and TEM. Staining techniques- simple, negative, Grams, spore, flagella, acid fast, volutin, capsule and Fielgen staining.
- Unit 4. Sterilisation and disinfection techniques- Physical and chemical methods- flaming, boiling, autoclaving, inspissation, Heat, Filtration, Radiation. Aseptic methods- laminar air flow hood. Disinfectants and its testing.

Suggested Readings

1. Fundamentals of Bacteriology by A.J Salle
2. Microbiology by Pelczar *et al*
3. Fundamentals of Microbiology by Mertus Frobisher
4. General microbiology by Stanier *et al*
5. Text book of Microbiology by Prescott.
6. Principles of Microbiology by Ronald Atlas
7. Microbiology: An Introduction by Tortora GJ, Funke BR, and Case CL.

8. Microbiology: Principles and Explorations by Black.
9. Brock Biology of Micro-organisms.

SEMESTER II

MBG2C02. APPLIED MICROBIOLOGY

2hrs/week

Credit 2

- Unit 1. Microbial growth: Effect of various parameters and Environmental factors on microbial growth- Temperature, pH, O₂, solute concentration and other factors. Classification based on specific requirement-based on temperature, pH, O₂ and solute concentration. Nutritional requirements of bacteria- C, electron, energy, and minerals. Nutritional types of bacteria- based on the requirement and their combinations. Modes of bacterial nutrition. Growth curve and its significance
- Unit 2. Culture media-Solid and liquid media, use of agar. Selective, Enrichment, Enriched, differential, selective-differential, indicator media, Transport media, simple and complex, synthetic or defined, Anaerobic media. Culture methods-Streak, spread, pour plate methods, stab culture and lawn culture. Cultivation of aerobic and anaerobic bacteria. Culture preservation strategies.
- Unit 3. Air Microbiology: Air microflora-sources, factors affecting air microflora, enumeration of microorganisms in air- settling under gravity, centrifugation, impingement, filtration, electrostatic precipitation, Airborne diseases-bacterial, fungal,viral.
- Unit 4. Water Microbiology: Factors affecting microbial population in natural waters - temperature, light, hydrogen concentration, pressure, salinity, nutrients, turbidity. Purification of water-aeration, sedimentation, coagulation, flocculation, sand filtration. waste water treatment- primary, secondary and tertiary stages. Disinfection of drinking water. Bacteriological techniques for examination of water potability. Indicator organisms, BOD

Suggested readings

1. Brock biology of Microorganisms-Madigam
2. Microbial Ecology by Atlas and Bartha
3. Fundamentals of Bacteriology by A.J .Salley

4. Microbiology by Pelczar *et al*
5. Fundamentals of Microbiology by Mertus Frobisher
6. General microbiology by Stanier *et al*
7. Text book of Microbiology by Prescott.
8. Principles of Microbiology by Ronald Atlas
9. Microbiology: An Introduction by Tortora GJ, Funke BR, and Case CL.
10. Microbiology: Principles and Explorations by Black.

SEMESTER III

MBG3C03 FOOD AND INDUSTRIAL MICROBIOLOGY

3hrs/week

Credit 2

Unit 1. Food Microbiology: Food as a substrate for microorganisms . Microorganisms important in food microbiology -molds, yeast, bacteria. Contamination of foods.

Unit 2. Spoilage of food -chemical changes caused by microorganisms . Spoilage of milk, meat, fish Methods of food preservation: Physical and chemical preservatives. Food poisoning-Bacterial.

Unit 3. Industrial Microbiology: Advantages of microbial process over chemical process, Fermentor- basic functions of a fermentor, structure and working . Batch culture, continuous culture, fed- batch culture. Production of penicillin, vitamin B-12, citric acid and bakers yeast, SCP. Steroid biotransformation .Downstream process.

Suggested readings

1. Industrial Microbiology -A. H. Patel
2. Industrial microbiology -Casida
3. Industrial Microbiology-Prescott & Dunn.
4. Environmental Microbiology- Joseph. C. Daniel
5. Food Microbiology, Fundamentals &Frontiers-Doyle.
6. Food Microbiology-William. C. Frazier

SEMESTER IV

MBG4C04. IMMUNOLOGY AND MEDICAL

2hrs/week

MICROBIOLOGY

Credit 2

Unit 1. Antigens-types, epitopes, haptens, Immunoglobulins: basic structure of immunoglobulin and different types.

Unit 2. Types of infection, Source of infection, Modes of transmission, Factors influencing the virulence of pathogens .Definitions of MID, ID50, MLD, LD50, bacteremia, Septicemia, contagious epidemic, endemic, pandemic, sporadic and prosodemic diseases.

Unit 3. Bacterial diseases caused by -*Staphylococcus aureus*, *Mycobacterium tuberculosis*, *Clostridium tetani*, *Clostridium botulinum*, *Vibrio cholerae*, *Salmonella typhi*.*Treponema pallidum*

Unit 4. Viral diseases - Rabies, AIDS, Hepatitis, An overview of emerging viral diseases: Chikungunya, dengue, H1N1, swine flu.

Unit 5. Fungal diseases- Superficial and deep mycoses, Protozoan diseases- Amoebiasis, Malaria.

Suggested Readings

1. Immunology-Janeway.
2. Immunology-Kuby.
3. Introduction to Microbiology-John. L. Ingraham
4. Introductory Mycology-Alexopoulos.
5. Medical Microbiology-Brooks, Butal, Slack.
6. Medical Microbiology-Ananthanarayanan & Jayaram Panicker.

MBG4C05 (P). MICROBIOLOGY PRACTICAL 2 Hrs/

Week in semesters I to IV

Credit 4

1. Cleaning and sterilization of glassware.
2. Introduction to hot air oven, autoclave and incubator.
3. Microscope and its maintenance.
4. Simple Staining.
5. Grams staining.
6. Capsule Staining.
7. Spore Staining.
8. motility- hanging drop method
9. Preparation of media (Nutrient broth, Nutrient agar,)
10. Use of EMB, Mc Conkey and Blood agar in bacterial charecterisation.
11. Isolation of pure culture by streak plate method.
12. Enumeration of microbial cells (pour and spread plate method).
13. Air sampling.
14. Aerobic mesophilic count of fish samples and milk.
15. Methylene blue reduction test.
16. Pellicle formation.
17. Microbiological analysis of drinking water
18. Biochemical reactions for identification of various groups of bacteria.
19. Antibiotic sensitivity test.
20. WIDAL agglutination.
21. RPR

NB. MB34C05 (P). Exam at the end of Semester IV

OPEN COURSE

MICROBIOLOGY

MBG5D01. PUBLIC HEALTH AND EMERGING MICROBIAL DISEASES

Hrs/Week 2

3 Credits

Unit 1. Concept of health, Dimensions of health, Human development index, Human poverty index, Gender related development index and gender empowerment measure. Determinants of health. Responsibility for health-Individual, Community, State and International responsibility. Indicators of health.

Unit 2. Infectious disease epidemiology. Definition of terms:-infection (primary, secondary, cross, nosocomial, iatrogenic, exogenous, endogenous, clinical , subclinical), contamination, infestation, host, infectious disease, communicable disease, epidemic, pandemic, endemic, sporadic, exotic, zoonotic, epizootic enzootic and epornithic diseases. Sources of infection and modes of transmission. Reservoirs, carriers and vectors of communicable diseases. Role of WHO in pandemic alerts.

Unit 3. Symptomatology, epidemiology, preventive measures of disease- Hepatitis,-A,B,E, HIV, Tuberculosis, Enteric fever, Weil's disease, microbial food poisonings. Emerging diseases- Dengue fever, Chikungunya, Swine flu. Bio-terrorism.

Suggested Readings

1. Ananthanarayan R and Paniker CKJ. (2005). *Textbook of Microbiology*. 7th edition (edited by Paniker CKJ). University Press Publication.
2. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). *Jawetz, Melnick and Adelberg's Medical Microbiology*. 24th edition. McGraw Hill Publication.
3. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). *Mims' Medical Microbiology*. 4th edition. Elsevier.
4. Joklik WK, Willett HP and Amos DB (1995). *Zinsser Microbiology*. 19th edition. Appleton- Century-Crofts publication.
5. Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.
6. *Medical Microbiology* : David Greenwood, Slack, Peutherer
7. Satish Gupte (2005). *The Short Textbook of Medical Microbiology*. Eighth edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.
8. Baron EJ, Peterson LR and Finegold SM (1994). *Bailey and Scotts diagnostic Microbiology*. 9th edition, Mosby publications.
9. Rajan S (2009). *Medical Microbiology*. First edition, MJP Publishers, Chennai.
10. Abbas AK, Lichtman AH, Pillai S. (2007). *Cellular and Molecular Immunology*. 6th edition aunders Publication, Philadelphia.

11. Delves P, Martin S, Burton D, Roitt IM. (2006). *Roitt's Essential Immunology*. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
12. Goldsby RA, Kindt TJ, Osborne BA. (2007). *Kuby's Immunology*. 6th edition W.H. Freeman and Company, New York.

MBG5D02. ENVIRONMENTAL MICROBIOLOGY

2 Hrs/Week

3 Credits

Unit 1. Soil Microbiology: Humus, Microflora of soil, Nitrogen cycle - Nitrogen fixation, nitrification, denitrification. Rhizosphere - Rhizosphere microorganisms.

Unit 2. Faecal pollution of water - waterborne diseases, indicator organisms. Microbiological examination of water. Water purification- aeration, sedimentation, coagulation, flocculation, sand filtration . Disinfection of drinking water , Sewage treatment.

Unit 3. Dispersal of airborne microorganisms, indoor outdoor air Droplet nuclei, aerosol, Air borne diseases.

Unit 4. Global environmental problems: ozone depletion, green house effect and acid rain, their impacts and biotechnological approaches for management. Definition of xenobiotics and biomagnification. composting , vermicomposting and biogas production.

Suggested Readings

1. Microbial Ecology by Ronald M. Atlas, Richard Bartha.
2. Microbiology concepts and applications by Pelzar *et al*
3. Microbiology by Prescott.
4. Fundamentals of Microbiology by Mertus Frobisher.
5. Hand book of water and waste water microbiology by Mara and Niger Horan.
6. Microbiological Examination Methods Of Food And Water By Silva
7. Text book of Biotechnology by BD Singh
8. Text book of Microbiology by Chakrabarthy
9. Microbial Ecology. John Wiley & Sons.
10. Campbell RE. (1983). *Microbial Ecology*. Blackwell Scientific Publication, Oxford, England.
11. Maier RM, Pepper IL and Gerba CP. (2009). *Environmental Microbiology*. 2nd edition, Academic Press.
12. Stolp H. (1988). *Microbial Ecology: Organisms Habitats Activities*. Cambridge University Press, Cambridge, England.

MODEL QUESTION PAPER

MBG3B03. ENVIRONMENTAL AND SANITATION MICROBIOLOGY

Time: 2.5 Hrs.

Maximum: 80 Marks

Wherever needed answers must be supported by structural illustrations and diagrams

Section A

*Short answer type questions: Answer **all** questions
Each question carries 2 marks*

Write briefly on:-

1. Superbug
2. BOD
3. Droplet nuclei
4. Andersen sampler
5. Recalcitrants
6. Trickling filters
7. Bioleaching
8. Coliforms
9. Methanogenesis
10. Biofiltration
11. EMB agar
12. Sulfur-reducing bacteria (SRB)
13. Imhoff tank
14. Aeroallergen
15. MPN

(Maximum: 25 marks)

Section B

*Paragraph type questions: Answer **all** questions
Each question carries 5 marks*

Write notes on:-

1. Microbiology of the composting process
2. Role of activated sludge in waste water treatment process
3. Microbial degradation of Xenobiotics
4. Biogas technology
5. Plant disease forecasting
6. Aerobiology and its role in the transmission of infectious diseases
7. Escherichia coli as an indicator of bacteriological quality of water
8. Air sampling procedures to evaluate microbial contamination

(Maximum: 35 marks)

Section C

*Essay type questions: Answer **any two** questions
Each question carries 10 marks*

Write essay on:-

1. Write the primary, secondary and tertiary treatment process used in wastewater treatment
2. Elaborate on the principle and procedures of microbial analysis of water
3. Explain in detail the process of bioremediation
4. What is solid waste management? Explain in detail the sources and methods of solid waste management.

(Maximum: 2 x 10 = 20 marks)

MODEL QUESTION PAPER

MBG5B08. IMMUNOLOGY

Time: 2.5 Hrs.

Maximum: 80 Marks

Wherever needed answers must be supported by structural illustrations and diagrams

Section A

*Short answer type questions: Answer **all** questions*

Each question carries 2 marks

Write briefly on:-

1. ADCC
2. Opsonization
3. Anaphylaxis
4. Ouchterlony immunodiffusion
5. Autoantigens
6. Hematopoiesis
7. Isograft and allograft
8. T Cell receptor
9. Hapten
10. Complement fixation test
11. Oncogenes
12. Epitope and paratope
13. Interferon (IFNs)
14. NK cell
15. Adaptive Immunity

(Maximum: 25 marks)

Section B

*Paragraph type questions: Answer **all** questions*

Each question carries 5 marks

Write notes on:-

1. Role of MHC in antigen presentation
2. Describe the production of monoclonal antibodies by hybridoma technology.
3. Explain agglutination reaction reactions and its applications
4. Immunology of graft rejection
5. Describe major factors that influence antigenicity
6. Describe the classical pathway of complement activation
7. Explain the process of B-cell activation and differentiation
8. Briefly describe the major organs of the immune system & their function

(Maximum: 35 marks)

Section C

*Essay type questions: Answer **any two** questions*

Each question carries 10 marks

Write essay on:-

1. Describe the structure and biological activities of the immunoglobulin classes
2. Define and classify immunity. Explain the mechanism of innate innate immunity
3. Give an account of autoimmune diseases
4. Discuss in detail on different hypersensitivity reactions

(Maximum: 2 x 10 = 20 marks)

MODEL QUESTION PAPER
MBG6B15 (E2). MOLECULAR BIOLOGY

Time: 2 Hrs.

Maximum: 60 Marks

Wherever needed answers must be supported by structural illustrations and diagrams

Section A

*Short answer type questions: Answer **all** questions
Each question carries 2 marks*

Write briefly on:-

1. TATA box
2. Cot analysis
3. Z-DNA
4. Okazaki fragments
5. Palindromic sequence
6. mRNA capping
7. Ames test
8. Suppressor mutations
9. SOS repair
10. Plasmid
11. D-loop replication
12. t- RNA

(Maximum: 20 marks)

Section B

*Paragraph type questions: Answer **all** questions
Each question carries 5 marks*

Write notes on:-

1. Genetic code and its properties
2. Describe in detail the role of enzymes in DNA replication
3. Post transcriptional modifications
4. Explain the steps involved in prokaryotic translation process
5. Histons and the role of Histone in DNA packaging
6. Hershey–Chase experiment
7. Different types of RNAs and their functions

(Maximum: 30 marks)

Section C

*Essay type questions: Answer **any one** question
Question carries 10 marks*

Write essay on:-

1. Explain the mechanism of regulation of gene express in bacteria in related to *lac-operon*.
2. Describe DNA damage and repair mechanisms

(Maximum: 1 x 10 = 10 marks)



UNIVERSITY OF CALICUT

Abstract

General and Academic - CBCSS UG Regulations 2019 - Choice Based Credit Semester System - Regulations for all UG Programmes under CBCSS - Regular and SDE/Private Registration - w.e.f. 2019 admissions - Corrections in Clause 9.2.1 - Approved - Erratum issued

G & A - IV - J

U.O.No. 18084/2019/Admn

Dated, Calicut University.P.O, 28.12.2019

Read:-U.O.No. 15324/2019/Admn dated 30.10.2019

ORDER

The following erratum is issued to the University Order read above.

ERRATUM**Clause 9.2.1. Internal Assessment**

- Components with percentage of marks of Internal Evaluation of Theory Courses are- Test paper 40%, Assignment 20%, Seminar 20% and Class room participation based on attendance 20%.
- The Split up of marks for Test paper and Class Room Participation (CRP) for internal evaluation are as follows.

Split up of marks for Test paper

Range of Marks in test paper	Out of 8 (Maximum internal marks is 20)	Out of 6 (Maximum internal marks is 15)
Less than 35%	1	1
35%- 45%	2	2
45% - 55%	3	3
55% - 65%	4	4
65% -85%	6	5
85% -100%	8	6

Split up of marks for Calss Room Participation

Range of CRP	Out of 4 (Maximum internal marks is 20)	Out of 3 (Maximum internal marks is 15)
50% ≤CRP <75%	1	1
75% ≤CRP <85%	2	2
85 % and above	4	3

(The U.O read above and corrected CBCSS UG Regulations 2019 are herewith appended)

Ajitha P.P

Joint Registrar

To

The Principals/Heads of all affiliated Colleges/Institutions/Departments under the University of Calicut
Copy to:Director SDE/ PS to VC/PA to R/PA to CE/GA IV B,C & E Sections/GA I F Section/CHMK
Library/SF/DF/FC

Forwarded / By Order

Section Officer



UNIVERSITY OF CALICUT

Abstract

General and Academic - CBCSS UG Regulations 2019 - Choice Based Credit Semester System - Regulations for all UG Programmes under CBCSS - Regular and SDE/Private Registration - w.e.f. 2019 admissions - Deleting Clause 6.12.6 and Modifying Clause 4.15 - Approved - Implemented - Orders issued

G & A - IV - J

U.O.No. 15324/2019/Admn

Dated, Calicut University.P.O, 30.10.2019

- Read:-*1. U.O No. GA I/J2/3601/08(Vol.II) dated 19.06.2009
2. U.O.No. 3797/2013/CU dated 07.09.2013
3. U.O No. 4368/2019/Admn dated 23.03.2019
4. Item No. 8 in the minutes of the meeting of Steering Committee on CBCSS UG 2019 held on 24.06.2019
5. Item No. 7 in the minutes of the meeting of Steering Committee on CBCSS UG 2019 held on 29.08.2019
6. Item No. I.12 in the minutes of the LXXX meeting of the Academic Council held on 05.10.2019
7. U.O No.15065/2019/Admn dated 26.10.2019

ORDER

Vide paper read as (1), the Regulations of Choice Based Credit Semester System for UG curriculum was implemented from 2009 admission onwards under the University of Calicut, as per the directions of Governing Council of the Kerala State Higher Education Council and vide paper read as (2), the Modified Regulations of Choice Based Credit Semester System for UG Curriculum was implemented from 2014 admission onwards under the University of Calicut, as per the recommendations of Hridayakumari Committee appointed by the Govt. of Kerala.

Vide paper read as (3), the Regulations for Choice Based Credit and Semester System for Under Graduate (UG) Curriculum - 2019 (CBCSS UG Regulations 2019) for all UG Programmes under CBCSS-Regular and SDE/Private Registration in the University of Calicut, with effect from 2019 admissions has been implemented.

Steering Committee on CBCSS UG 2019 considered the issue of credit distribution of project in Dual Core Programmes vide paper read as (4) and recommended that one Project with 3 credits shall be done in any of the two core subjects in the case of Dual Core Programmes. It was also recommended vide paper read as (5) to amend the CBCSS UG Regulations 2019 by deleting the Clause 6.12.6 - "For readmission, the vacancy should be within the sonctioned strength in the parent college. If there is no vacancy in the junior botch of the parent college, readmission can be taken in another college with the junior batch if there is vacancy within the sonctioned strength in the concerned college" .

The recommendations of Steering Committee have been approved by the LXXX meeting of Academic Council vide paper read as (6) and the Vice Chancellor has ordered to implement the same.

Sanction has, therefore, been accorded by the Vice Chancellor to modify the CBCSS UG Regulations 2019 by modifying the Clause 4.15 and deleting the Clause 6.12.6 as recommended by the Steering Committee on CBCSS UG 2019.

Orders are issued accordingly.

U.O No. 4368/2019/Admn dated 23.03.2019 modified to this extent and U.O No.15065/2019/Admn dated 26.10.2019 stands cancelled.

(The CBCSS UG Regulations 2019 is herewith appended)

Biju George K

Assistant Registrar

To

The Principals/Heads of all affiliated Colleges/Institutions/Departments under the University of Calicut

Copy to:Director SDE/ PS to VC/PA to R/PA to CE/GA IV B,C & E Sections/GA I F Section/CHMK Library/SF/DF/FC

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UNIVERSITY OF CALICUT

**REGULATIONS FOR
CHOICE BASED CREDIT AND
SEMESTER SYSTEM FOR UNDER
GRADUATE (UG) CURRICULUM -2019
(CBCSSUG 2019)**

PREFACE

Global forces are combining to fabricate rapid and profound changes on a heretofore unknown scale, that too, in fathomless velocity, leaving none of our systems unscathed, including the global system of higher education. Higher education system, globally, is being placed in an entirely different setting, with the pervading of market, offering a competing paradigm and restructuring the interplay between the Market, the State and the Universities at the advent of globalization.

New terminologies such as 'Borderless Education', 'Cross border Education', '*Transnational* and *Transborder* Education', 'internationalization' and 'commoditization' of education etc., have become a few catch words in this era of liberalisation. Higher Education ceases to be a 'common good' and is being swiftly transformed to be an internationally traded commodity. In all modern societies, universities are considered as the 'knowledge factories'.

The Indian system of higher education has unleashed major program of reforms in the event of the changes witnessed in the system. Many of these reforms can be traced back to a policy template provided by the National Knowledge Commission (NKC). In purview with such reforms, the University Grants Commission (UGC) has made concurrent changes with regard to the higher education system. One such change was the introduction of CBCSS or 'Choice based Credit Semester and grading pattern'. The UGC directed all the Universities in the country to restructure undergraduate courses on 'Choice based Credit Semester and Grading pattern' in 2009-10 academic year. **Recommendation of the UGC in its *Action Plan for Academic and Administrative Reforms makes it clear that* "..... Curricular flexibility and learners' mobility is an issue that warrants our urgent attention. These can be addressed by introducing credit based courses and credit accumulation. In order to provide with some degree of flexibility to learners, we need to provide for course duration in terms of credit hours and also a minimum as well as a maximum permissible span of time in which a course can be completed by a learner...Choice-Based Credit System (CBCS) imminently fits into the emerging socioeconomic milieu, and could effectively respond to the educational and occupational aspirations of the upcoming generations. In view of this, institutions of higher education in India would do well to invest thought and resources into introducing CBCS. Aided by modern communication and information technology, CBCS has a high probability to be operational efficiently and effectively elevating learners, institutions and higher education system in the country to newer heights..."**

Calicut University regulations are framed in accordance with UGC guidelines on restructuring undergraduate education from 2009-10 academic year itself. Accordingly, all affiliated colleges have restructured the regular undergraduate programs on the Choice Based Credit Semester System (CBCSS), a combination of internal and external evaluation with grading. Later the system was made applicable to the School of Distance Education too. Now, a revised regulation for the UG Choice Based Credit Semester System is being prepared for ensuring quality and learner-centeredness. It is called as the **Regulations for Choice Based Credit and Semester System for Undergraduate (UG) Curriculum -2019. This booklet contains the details of the new regulation.**

**Regulations for Choice Based Credit and Semester System for
Under Graduate (UG) Curriculum -2019**

1. TITLE

These regulations shall be called “ Regulations for Choice Based Credit and Semester System for Under Graduate Curriculum 2019” (CBCSSUG 2019).

2. SCOPE, APPLICATION & COMMENCEMENT

2.1. The regulations provided herein shall apply to all Regular/SDE/Private UG programmes under various Faculties (specified in 4.1) conducted by the University of Calicut for the admissions commencing from 2019, with effect from the academic year 2019-2020.

2.2. The provisions herein supersede all the existing regulations for the regular UG programmes under various Faculties conducted by University of Calicut unless otherwise specified.

2.3. Every programme conducted under the Choice Based Credit and Semester System in a college shall be monitored by the College Council and every UG programme conducted under CBCSS UG in SDE/Private Registration shall be monitored by the Director, SDE.

3. DEFINITIONS

3.1. ‘Programme’ means the entire course of study and examinations for the award of a degree.

3.2. ‘Duration of programme’ means the time period required for the conduct of the programme. The duration of a UG degree programme shall be six semesters distributed in a period of 3 years or eight semesters in a period of 4 years.

3.3. ‘Academic Week’ is a unit of five working days in which distribution of work is organized from day one to day five, with five contact hours of one hour duration on each day. A sequence of 18 such academic weeks constitutes a semester.

3.4. ‘Semester’ means a term consisting of 18 weeks (16 instructional weeks and two weeks for examination).

3.5. ‘Course’ means a segment of subject matter to be covered in a semester.

3.6. ‘Common course’ means a course that comes under the category of courses, including compulsory English and additional language courses and a set of general courses applicable for Language Reduced Pattern (LRP) programmes, the selection of which is compulsory for all students undergoing UG programmes.

3.7.‘Core course’ means a compulsory course in a subject related to a particular degree programme.

3.8. ‘Open course’ means a course which can be opted by a student at his/her choice.

3.9.‘Complementary course’ means a course which is generally related to the core course.

3.10.‘Improvement course’ is a course registered by a student for improving his/her performance in that particular course.

- 3.11. 'Ability Enhancement course/Audit course'** is a course which is mandatory as per the directions from the Regulatory authorities like UGC, Supreme Court etc.
- 3.12. 'Department'** means any Teaching Department in a college offering a course of study approved by the University as per the Statutes and Act of the University.
- 3.13. 'Department Co-ordinator'** is a teacher nominated by a Dept. Council to co-ordinate all the works related to CBCSS UG undertaken in that department including continuous evaluation.
- 3.14. 'Department Council'** means the body of all teachers of a department in a college.
- 3.15. 'Parent Department'** means the Department which offers a particular degree programme.
- 3.16. 'College Co-ordinator'** is a teacher nominated by the college council to co-ordinate the effective running of the process of CBCSS including internal evaluation undertaken by various departments within the college. She/he shall be the convenor for the College level monitoring committee.
- 3.17. College level monitoring committee.** A monitoring Committee is to be constituted for CBCSSUG at the college level with Principal as Chairperson, college co-ordinator as convenor and department co-ordinators as members. The elected College union chairperson shall be a member of this committee.
- 3.18. 'Faculty Adviser'** means a teacher from the parent department nominated by the Department Council, who will advise the student in the academic matters and in the choice of open courses.
- 3.19. 'Credit' (C)** is a unit of academic input measured in terms of weekly contact hours/course contents assigned to a course.
- 3.20. 'Extra Credit'** is the additional credit awarded to a student over and above the minimum credits required in a programme, for achievements in co-curricular activities and social activities conducted outside the regular class hours, as decided by the University. For calculating CGPA, extra credits will not be considered.
- 3.21. 'Letter Grade'** or simply 'Grade' in a course is a letter symbol (O, A+, A, B+, B, C, P, F,I and Ab). Grade shall mean the prescribed alphabetical grade awarded to a student based on his/her performance in various examinations. The Letter grade that corresponds to a range of CGPA is given in Annexure-I.
- 3.22.** Each letter grade is assigned a '**Grade point**' (**G**) which is an integer indicating the numerical equivalent of the broad level of performance of a student in a course. **Grade Point** means point given to a letter grade on 10 point scale.
- 3.23. 'Semester Grade Point Average' (SGPA)** is the value obtained by dividing the sum of credit points obtained by a student in the various courses taken in a semester by the total number of credits in that semester. SGPA shall be rounded off to three decimal places. SGPA determines the overall performance of a student at the end of a semester.

3.24. 'Credit Point' (P) of a course is the value obtained by multiplying the grade point (G) by the credit (C) of the course: $P=G \times C$

3.25. 'Cumulative Grade Point Average' (CGPA) is the value obtained by dividing the sum of credit points in all the semesters taken by the student for the entire programme by the total number of credits in the entire programme and shall be rounded off to three decimal places.

3.26. Grade Card means the printed record of students' performance, awarded to him/her.

3.27. Course teacher: A teacher nominated by the Head of the Department shall be in charge of a particular course.

3.28. 'Dual core' means a programme with double core subjects, traditionally known as double main.

3.29. 'Strike off the roll' A student who is continuously absent for 14 days without sufficient reason and proper intimation to the Principal of the college shall be removed from the roll.

3.30. Words and expressions used and not defined in this regulation, but defined in the Calicut University Act and Statutes shall have the meaning assigned to them in the Act and Statutes.

4. PROGRAMME STRUCTURE

4.1. Students shall be admitted to UG programme under Faculty of Science, Humanities, Language & Literature, Commerce & Management, Fine Arts, Journalism and such other faculty constituted by University from time to time.

4.2. Duration: The duration of a UG programme shall be 6 semesters distributed over a period of 3 academic years. The odd semesters (1,3,5) shall be from June to October and the even semesters (2,4,6) shall be from November to March.

4.3. Courses: The UG programme shall include five types of courses, viz; Common Courses (Code A), Core courses (Code B), Complementary courses (Code C), Open Course (Code D) and Audit courses (Code E).

4.4. Course code : Each course shall have a unique alphanumeric code number, which includes abbreviation of the subject in three letters, the semester number (1 to 6) in which the course is offered, the code of the course (A to E) and the serial number of the course (01,02). The course code will be centrally generated by the university. For example: ENG2A03 represents a common course of serial number 03 offered in the second semester and PHY2B02 representing second semester Core course 2 in Physics programme.

4.5. Common Courses: In general, every UG student shall undergo 10 common courses (total 38 credits) chosen from a group of 14 common courses listed below, for completing the programme:

A01. Common English Course I	English courses A01-A06 applicable to BA/BSC Regular pattern
A02. Common English Course II	
A03. Common English Course III	English courses A01-A04 applicable to Language Reduced
A04. Common English Course IV	

A05. <i>Common English Course V</i> A06. <i>Common English Course VI</i>	Pattern (LRP) Programmes B.com, BBA, BBA (T), BBM, B.Sc (LRP), BCA etc.
A07. <i>Additional Language Course I</i> A08. <i>Additional Language Course II</i> A09. <i>Additional Language Course III</i> A10. <i>Additional Language Course IV</i>	Addl. Language courses A07-A10 applicable to BA/B.Sc Regular Pattern Addl. Language courses A07-A08 applicable to Language Reduced Pattern (LRP) Programmes
A11. <i>General Course I</i> A12. <i>General Course II</i> A13. <i>General Course III</i> A14. <i>General Course IV</i>	Applicable to Language Reduced Pattern (LRP) Programmes

Common courses A01-A06 shall be taught by English teachers and A07-A10 by teachers of additional languages respectively. General courses A11-A14 shall be offered by teachers of departments offering core courses concerned.

General courses I, II, III and IV shall be designed by the group of boards concerned.

The subjects under Language Reduced Pattern (LRP) (Alternative Pattern) are grouped into five and General Courses I, II, III & IV shall be the same for each group.

1. BBA, B.Com., Fashion Technology, Hotel Management.
2. Industrial Chemistry, Polymer Chemistry, Food Science and Technology.
3. Computer Science, Electronics, Instrumentation, Printing Technology, Computer Application.
4. Biotechnology, Biochemistry, Aquaculture, Plant Science.
5. B.A Multimedia, B.A Visual Communication, B.A Film and Television.

**** Common Courses in various programmes**

No.	Programme	Semester I	Semester II	Semester III	Semester IV
1	B.A. & B.Sc	A01, A02, A07	A03, A04, A08	A05, A09	A06, A10
2	LRP	A01, A02, A07*	A03, A04, A08*	A11, A12	A13, A14

* However the existing additional language pattern shall be continued.

** The language pattern of BBA shall be the same as that of B.Com. in colleges where both the programmes exist.

4.6. Core courses: Core courses are the courses in the major (core) subject of the degree programme chosen by the student. Core courses are offered by the parent department.

4.7. Complementary courses: Complementary courses cover one or two disciplines that are related to the core subject and are distributed in the first four semesters. There shall be one complementary course in a semester for B.A Programmes. The complementary courses in first and fourth semester (Type 1) shall be the same. Similarly the complementary courses in second and third semester (Type 2) shall be the same. The college can choose any complementary course either in Type 1 or in Type 2 for a programme. Once they choose the complementary courses that should be intimated to the university. If a college wants to change the complementary course pattern (Type 1 or Type 2) prior sanction has to be obtained. All other programmes, existing pattern will follow.

4.8. Open courses: There shall be one open course in core subjects in the fifth semester. The open course shall be open to all the students in the institution except the students in the parent department. The students can opt that course from any other department in the institution. Each department can decide the open course from a pool of three courses offered by the University. Total credit allotted for open course is 3 and the hours allotted is 3. If there is only one programme in a college, they can choose either language courses or physical education as open course.

4.9. Common and open courses under SDE/Private Registration: Existing pattern (as in CUCBCSSUG 2014) shall be followed under SDE/Private Registration.

4.10. Ability Enhancement courses/Audit courses: These are courses which are mandatory for a programme but not counted for the calculation of SGPA or CGPA. There shall be one Audit course each in the first four semesters. These courses are not meant for class room study. The students can attain only pass (Grade P) for these courses. At the end of each semester there shall be examination conducted by the college from a pool of questions (Question Bank) set by the University. The students can also attain these credits through online courses like SWAYAM, MOOC etc (optional). The list of passed students must be sent to the University from the colleges at least before the fifth semester examination. The list of courses in each semester with credits are given below.

Course with credit	Semester
Environment Studies – 4	1
Disaster Management - 4	2
*Human Rights/Intellectual Property Rights/ Consumer Protection - 4	3
*Gender Studies/Gerontology- 4	4

* Colleges can opt any one of the courses.

4.11. Extra credit Activities: Extra credits are mandatory for the programme. Extra credits will be awarded to students who participate in activities like NCC, NSS and Swatch Bharath. Those students who could not join in any of the above activities have to undergo Calicut University Social Service Programme (CUSSP). Extra credits are not counted for SGPA or CGPA.

4.12. Credits: A student is required to acquire a minimum of 140 credits for the completion of the UG programme, of which 120 credits are to be acquired from class room study and shall only be counted for SGPA and CGPA. Out of the 120 credits, 38 (22 for common (English) courses + 16 for common languages other than English) credits shall be from common courses, 2 credits for project/corresponding paper and 3 credits for the open course. (In the case of LRP Programmes 14 credits for common courses (English), 8 credits for additional

language courses and 16 credits for General courses). The maximum credits for a course shall not exceed 5. Dual core programmes are having separate credit distribution. Audit courses shall have 4 credits per course and a total of 16 credits in the entire programme. The maximum credit acquired under extra credit shall be 4. If more Extra credit activities are done by a student, that may be mentioned in the Grade card. The credits of audited courses or extra credits are not counted for SGPA or CGPA.

4.13. Attendance: A student shall be permitted to appear for the semester examination, only if he/she secures not less than 75% attendance in each semester. Attendance shall be maintained by the Department concerned. Condonation of shortage of attendance to a maximum of 10% in the case of single condonation and 20% in the case of double condonation in a semester shall be granted by University remitting the required fee. Benefits of attendance may be granted to students who attend the approved activities of the college/university with the prior concurrence of the Head of the institution. Participation in such activities may be treated as presence in lieu of their absence on production of participation/attendance certificate (within two weeks) in curricular/extracurricular activities (maximum 9 days in a semester). Students can avail of condonation of shortage of attendance in a maximum of four semesters during the entire programme (Either four single condonations or one double condonation and two single condonations during the entire programme) . If a student fails to get 65% attendance, he/she can move to the next semester only if he/she acquires 50% attendance. In that case, a **provisional registration** is needed. Such students can appear for supplementary examination for such semesters after the completion of the programme. Less than 50% attendance requires Readmission. Readmission is permitted only once during the entire programme.

4.14. Grace Marks: Grace marks may be awarded to a student for meritorious achievements in co-curricular activities (in Sports/Arts/NSS/NCC/Student Entrepreneurship) carried out besides the regular hours. Such a benefit is applicable and limited to a maximum of 8 courses in an academic year spreading over two semesters. In addition, maximum of 6 marks per semester can be awarded to the students of UG Programmes, for participating in the College Fitness Education Programme (COFE).

4.15. Project: Every student of a UG degree programme shall have to work on a project of 2 credits under the supervision of a faculty member or shall write a theory course based on Research Methodology as per the curriculum. College shall have the liberty to choose either of the above. One Project with 3 credits shall be done in any of the two core subjects in the case of Dual Core programmes.

But SDE/Private Registration students shall write the Research Methodology course instead of project. Board of Studies concerned shall prepare the syllabus for the same.

5. BOARD OF STUDIES AND COURSES

5.1. The UG Boards of Studies concerned shall design all the courses offered in the UG programmes. The Boards shall design and introduce new courses, modify or re-design existing courses and replace any existing courses with new/modified/re-designed courses to facilitate better exposure and training for the students.

5.2. The Syllabus of a course shall include the title of the course, the number of credits, maximum marks for external and internal evaluation, duration of examination hours, distribution of internal marks and reference materials. The Board of Studies concerned has the liberty to decide whether the questions can be answered in Malayalam or not. Maximum efforts shall be made to maintain a uniform pattern while designing the courses, project, viva, practical etc. in the scheme and syllabus of various programmes coming under same faculty.

5.3. The Syllabus for Common Courses, eventhough prepared by different Boards of Studies, may be put under a separate head as Syllabus for Common Courses.

5.4. Each course have an alpha numeric code, the number of credits and title of the course. The code gives information on the subject, the semester number and the serial number of the course. Each module/chapter may mention the number of questions to be asked in each section in the Question paper.

5.5. The syllabus of each course shall be prepared module wise. The course outcomes are to be clearly stated in the syllabus of all subjects including laboratory subjects, The number of instructional hours and reference materials are also to be mentioned against each module. Since a semester contains 16 instructional weeks, the same may be considered in the preparation of the syllabi.

5.6. The scheme of examination and model question papers are to be prepared by the Board of Studies. The number of questions from each module in each section may be given along with the syllabus.

5.7. A Question Bank system shall be introduced. Boards of Studies shall prepare a Question Bank, modulewise, at least 8 times to that required for a Question paper.

5.8. Boards of Studies should make the changes in the syllabi and text books in consultation with the teachers. Each Course should have a Preamble which clearly signifies the importance of that course. The Higher secondary syllabus also to be taken into account while preparing the UG syllabus.

5.9. Boards of Studies have to be constantly in touch with renowned Indian Universities and at least a few foreign universities. Subject experts have to be identified in all major fields of study and endeavour, and consulted frequently.

6. ADMISSION

6.1. The admission to all programmes will be as per Rules and Regulations of the University.

6.2.The eligibility criteria for admission shall be as announced by the University from time to time.

6.3. Separate rank lists shall be drawn up for reserved seats as per the existing rules.

6.4. The admitted candidates shall subsequently undergo the prescribed courses of study in a college affiliated to the University for six semesters within a period of not less than three years; clear all the examinations prescribed and fulfil all such conditions as prescribed by the University from time to time.

6.5. The college shall make available to all students admitted a **prospectus** listing all the courses offered in various departments during a particular semester. The information so provided shall contain title of the courses, the semester in which it is offered and credits for the courses. Detailed syllabi shall be made available in the University/college websites.

6.6. There shall be a uniform **calendar** prepared by the University for the registration, conduct/schedule of the courses, examinations and publication of results. The University shall ensure that the calendar is strictly followed.

Admission notification and the academic calendar for SDE/ Private Registration will be prepared and issued by SDE.

6.7. There shall be provision for **Inter Collegiate and Inter University Transfer** in third and fifth semester within a period of two weeks from the date of commencement of the semester. College transfer may be permitted in Second and Fourth semester also without change in complementary course within a period of two weeks from the date of commencement of the semester concerned.

6.8. Complementary change at the time of college transfer is permitted in the third semester if all conditions are fulfilled.

6.8.1. Core/Complementary change under SDE/Private Registration: Existing rule (as in CUCBCSS UG 2014) shall be followed in Core/Complementary Change.

6.9. CBCSS regular students can join distance education stream/Private Registration in any semester in the same programme or different one. If core and complementary courses are different, they have to undergo them in the new stream. The marks/grace obtained for common courses will be retained.

6.10. A student registered under distance education stream/Private Registration in the CBCSS pattern may be permitted to join the regular college (if there is a vacancy within the sanctioned strength) in the third and fifth semester with the same programme only. If there is a change in complementary courses, it can be done with following conditions: i) the external and internal marks/grade obtained in the previous semesters for the earlier complementary courses will be cancelled. ii) the students have to write the external examinations for the previous semester for the new complementary courses along with the subsequent batch. iii) An undertaking to the effect that “the internal evaluation for the previous semesters of the

new complementary courses will be conducted”, is to be obtained from the Principal of the college in which the student intends to join.

6.11. Provision for **credit transfer** is subject to common guidelines prepared by the faculty concerned.

6.12. There shall be provision for **Readmission** of students in CBCSS UG 2019.

6.12.1. The Principal can grant readmission to the student, subject to the conditions detailed below and inform the matter of readmission to the Controller of Examinations within one month of such readmission.

6.12.2. This readmission is not to be treated as college transfer.

6.12.3. There should be a gap of at least one semester for readmission.

6.12.4. The candidate seeking readmission to a particular semester should have registered for the previous semester examination.

6.12.5. Readmission shall be taken within two weeks from the date of commencement of the semester concerned.

6.12.6. Deleted.

6.12.7. If there is a change in complementary courses, it can be done with following conditions: i) the external and internal marks/grade obtained in the previous semesters for the earlier complementary courses will be cancelled. ii) the students have to write the external examinations for the previous semester for the new complementary courses along with the subsequent batch iii) An undertaking to the effect that “the internal evaluation for the previous semesters of the new complementary courses will be conducted”, is to be obtained from the Principal of the college in which the student intends to take readmission.

6.12.8. If change in scheme occurs while readmission, provision for credit transfer is subject to common guidelines prepared by Board of Studies/ Faculty concerned. For readmission to CBCSS UG 2019 involving scheme change, the Principal concerned shall report the matter of readmission to Controller of Examinations with the details of previous semesters and course undergone with credits within two weeks in order to fix the deficiency/excess papers.

7. REGISTRATION

7.1. Each student shall make an online registration for the courses he/she proposes to take, in consultation with the Faculty Adviser within two weeks from the commencement of each semester. The college shall send a list of students registered for each programme in each semester giving the details of courses registered, including repeat courses, to the University in the prescribed form within 45 days from the commencement of the semester.

It is mandatory that the students who got admission under CBCSS UG 2019 in SDE/Private shall register for the examinations of the concerned semesters in the same year itself.

7.2. A student shall be normally permitted to register for the examination if he/she has required minimum attendance. If the student has a shortage of attendance below 65% in a

semester, the student shall be permitted to move to the next semester (if the attendance is more than 50% - Provisional registration) and can write the examination for the entire courses of the semester in which shortage of attendance occurs as supplementary examination only after the completion of the entire programme. In such cases, a request from the student may be forwarded through the Principal of the college to the Controller of Examinations within two weeks of the commencement of the semester. If the attendance is less than 50%, the student is ineligible to continue the programme and has to seek readmission. **There will not be any Repeat semester in CBCSSUG 2019.**

7.3. A student who registered for the course shall successfully complete the programme within 6 years from the year of first registration. If not, such candidate has to cancel the existing registration and join afresh as a new candidate.

7.4. For open courses there shall be a minimum of 10 and maximum of 75 students per batch. For other courses existing pattern will be followed.

7.5. Those students who have followed the UG Programmes in annual pattern or Choice based Credit & Semester System pattern can cancel their earlier registration and register afresh for CBCSSUG 2019 scheme in the same discipline or a different one.

7.6. The students who have attendance within the limit prescribed, but could not register for the examination have to apply for **Token registration**, within two weeks of the commencement of the next semester.

8. EXAMINATION

8.1. There shall be University examinations at the end of each semester.

8.2. Practical examinations shall be conducted by the University as prescribed by the Board of Studies.

8.3. External viva-voce, if any, shall be conducted along with the practical examination/project evaluation.

8.4. The model of question papers may be prepared by the concerned Board Of Studies. Each question should aim at – (1) assessment of the knowledge acquired (2) standard application of knowledge (3) application of knowledge in new situations.

8.5. Different types of questions shall possess different marks to quantify their range. A general scheme for the questionpaper is given in Annexure III.

8.6. Project evaluation shall be conducted at the end of sixth semester. 20% of marks are awarded through internal assessment.

8.7. Audit course: The students can attain only pass (Grade P) for these courses. At the end of each semester there shall be examination conducted by the college from a pool of questions set by the University. The students can also attain the credits through online courses like SWAYAM, MOOC etc. The College shall send the list of passed students to the University at least before the commencement of fifth semester examination.

8.8. Improvement course: Improvement of a particular semester can be done only once. The student shall avail of the improvement chance in the succeeding year after the successful completion of the semester concerned. The students can improve a maximum of two courses in a particular semester (for SDE/Private registration students also). The internal marks already obtained will be carried forward to determine the new grade/mark in the improvement examination (for regular students). If the candidate fails to appear for the improvement examination after registration, or if there is no change in the results of the improved examination, the mark/grade obtained in the first appearance will be retained.

Improvement and supplementary examinations cannot be done simultaneously.

8.9. Moderation: Moderation is eligible as per the existing rules of the Academic Council.

9. EVALUATION AND GRADING

9.1. Mark system is followed instead of direct grading for each question. For each course in the semester letter grade and grade point are introduced in 10-point indirect grading system as per guidelines given in Annexure-1

9.2. Course Evaluation

The evaluation scheme for each course shall contain two parts

1) Internal assessment 2) External Evaluation

20% weight shall be given to the internal assessment. The remaining 80% weight shall be for the external evaluation.

9.2.1. Internal Assessment

20% of the total marks in each course are for internal examinations. The marks secured for internal assessment only need to be sent to University by the colleges concerned.

The internal assessment shall be based on a predetermined transparent system involving written tests, Class room participation based on attendance in respect of theory courses and lab involvement/records attendance in respect of Practical Courses.

Internal assessment of the project will be based on its content, method of presentation, final conclusion and orientation to research aptitude.

Components with percentage of marks of Internal Evaluation of Theory Courses are-Test paper 40%, Assignment 20%, Seminar 20% and Class room participation based on attendance 20%.

For practical courses - Record 60% and lab involvement 40% as far as internal is concerned.

(if a fraction appears in internal marks, nearest whole number is to be taken)

For the test paper marks, at least one test paper should be conducted. If more test papers are conducted, the mark of the best one should be taken.

To ensure transparency of the evaluation process, the internal assessment marks awarded to the students in each course in a semester shall be notified on the notice board at least one week before the commencement of external examination. There shall not be any chance for improvement for internal marks. The course teacher(s) shall maintain the academic record of

each student registered for the course, which shall be forwarded to the University by the college Principal after obtaining the signature of both course teacher and Head of the Department.

The Split up of of marks for Test paper and Class Room Participation (CRP) for internal evaluation are as follows.

Split up of of marks for Test paper

Range of Marks in test paper	Out of 8 (Maximum internal marks is 20)	Out of 6 (Maximum internal marks is 15)
Less than 35%	1	1
35% - 45%	2	2
45% - 55%	3	3
55% - 65%	4	4
65% -85%	6	5
85% -100%	8	6

Split up of of marks for Calss Room Participation

Range of CRP	Out of 4 (Maximum internal marks is 20)	Out of 3 (Maximum internal marks is 15)
50% ≤ CRP < 75%	1	1
75% ≤ CRP < 85%	2	2
85 % and above	4	3

9.2.2. Internal Assessment for SDE/Private Registration : Regarding internal component, the student will have to attend a fill in the blank type/multiple choice type examination of 20 marks along with the external examination in SDE mode. The attendance component of internal marks is not mandatory for such students.

9.2.3. External Evaluation

External evaluation carries 80% of marks. All question papers shall be set by the University. The external question papers may be of uniform pattern with 80/60 marks (The pattern is given in the Annexure III). The courses with 2/3 credits will have an external examinaion of 2 hours duration with 60 marks and courses with 4/5 credits will have an external examination of 2.5 hours duration with 80 marks.

The external examination in theory courses is to be conducted by the University with question papers set by external experts. The evaluation of the answer scripts shall be done by examiners based on a well-defined scheme of valuation and answer keys shall be provided by the University. The external examination in practical courses shall be conducted by two

examiners – one internal and an external, the latter appointed by the University. The project evaluation with viva can be conducted either internal or external which may be decided by the Board of Studies concerned. (Guidelines are given in the Annexure II).

After the external evaluation only marks are to be entered in the answer scripts. All other calculations including grading are done by the University.

9.2.4. Revaluation: In the new system of grading, revaluation is permissible. The prevailing rules of revaluation are applicable to CBCSSUG 2019.

Students can apply for photocopies of answer scripts of external examinations. Applications for photocopies/scrutiny/revaluation should be submitted within 10 days of publication of results. The fee for this shall be as decided by the University.

10. INDIRECT GRADING SYSTEM

10.1. Indirect grading System based on a 10-point scale is used to evaluate the performance of students.

10.2. Each course is evaluated by assigning marks with a letter grade (O, A+, A, B+, B, C, P, F, I or Ab) to that course by the method of indirect grading. (Annexure I).

10.3. An aggregate of P grade (after external and internal put together) is required in each course for a pass and also for awarding a degree (A minimum of 20% marks in external evaluation is needed for a pass in a course. But no separate pass minimum is needed for internal evaluation). No separate grade/mark for internal and external will be displayed in the grade card; only an aggregate grade will be displayed. Also the aggregate mark of internal and external are not displayed in the grade card.

10.4. A student who fails to secure a minimum grade for a pass in a course is permitted to write the examination along with the next batch.

10.5. After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below. For the successful completion of a semester, a student should pass all courses. However, a student is permitted to move to the next semester irrespective of SGPA obtained.

SGPA of the student in that semester is calculated using the formula

$$\text{SGPA} = \frac{\text{Sum of the credit points of all courses in a semester}}{\text{Total credits in that semester}}$$

10.6. The Cumulative Grade Point Average (CGPA) of the student is calculated at the end of a programme. The CGPA of a student determines the overall academic level of the student in a

programme and is the criterion for ranking the students. CGPA can be calculated by the following formula.

$$\text{CGPA} = \frac{\text{Total credit points obtained in six semesters}}{\text{Total credits acquired (120)}}$$

10.7. SGPA and CGPA shall be rounded off to three decimal places. CGPA determines the broad academic level of the student in a programme and is the index for ranking students (in terms of grade points). An overall letter grade (cumulative grade) for the entire programme shall be awarded to a student depending on her/his CGPA (Annexure-I)

11. GRADE CARD

11.1. The University shall issue to the students grade/marks card (by online) on completion of each semester, which shall contain the following information:

- Name of University
- Name of College
- Title of UG Programme
- Semester concerned
- Name and Register Number of student
- Code number, Title and Credits of each Course opted in the semester
- Letter grade in each course in the semester
- The total credits, total credit points and SGPA in the Semester (corrected to three decimal places)

11.2. The final Grade card issued at the end of the final semester shall contain the details of all courses taken during the entire programme including those taken over and above the prescribed minimum credits for obtaining the degree. The final grade card shall show CGPA (corrected to three decimal places), percentage of marks (corrected to two decimal places) and the overall letter grade of a student for the entire programme. The final grade card shall also include the CGPA and percentage of marks of common courses, core courses, complementary courses and open courses separately. This is to be done in a 10- point indirect scale. The final Grade card also contain the list of Audit courses passed and the details of Extra credits.

11.3. Evaluation of Audit courses: The examination shall be conducted by the college itself from the Question Bank prepared by the University. The Question paper shall be of 100 marks of 3 hour duration. For SDE/Private students it may be of MCQ/ fill in the blank type questions or Online question paper may be introduced.

12. CALICUT UNIVERSITY SOCIAL SERVICE PROGRAMME (CUSSP)

In this programme, a student has to complete 12 days of social service. This has to be completed in the first four semesters; 3 days in each semester. For the regular programme the student has to work in a Panchayath or Local body or in a hospital/ poor home or old age home or in a Pain & paliative centre or any social work assigned by the College authorities.

Students who engaged in College Union activities and participate in sports and cultural activities in Zonal level have to undergo only 6 days of CUSSP during the entire programme. The whole documents regarding the student should be kept in the college and the Principal should give a Certificate for the same. The list of students (successfully completed the programme) must be sent to the University before the commencement of the fifth semester examinations. A College level Co-ordinator and a Department level Co-ordinator shall be appointed for the smooth conduct of the programme.

12.1. CUSSP for SDE/Private students: For SDE/Private students, out of the 12 days, the student has to undergo 6 days in a Panchayath or Local body and the remaining 6 days in a Hospital/ Old age home or in a Pain and paliative centre.. The respective certificate should uploaded to the University (before the commencement of fifth semester examinations) in respective student portal and the University should provide an Online Certificate for the same.

13. AWARD OF DEGREE

The successful completion of all the courses (common, core, complementary and open courses) prescribed for the degree programme with 'P' grade shall be the minimum requirement for the award of degree.

13.1. Degree for Oriental Title courses: Those students who have passed Oriental Title courses earlier have to appear for the common courses. A 01 to A 06 in order to get POT degree. This can be done through SDE/Private Registration (SDE/Private registration along with the First semester students).

13.2. For obtaining Additional Degree: Those students who have passed UG programme under CCSS/CUCBCSS 2014 have to appear for only Core, Complementary and Open courses for acquiring additional degree. The registration for additional degree shall be done through SDE/ Private Registration in the third semester as per existing rules.

14. GRIEVANCE REDRESSAL COMMITTEE

14.1. Department level: The college shall form a Grievance Redressal Committee in each department comprising of course teacher, one senior teacher and elected representative of students (Association Secretary) as members and the Head of the Department as Chairman. This committee shall address all grievances relating to the internal assessment grades of the students.

14.2. College level: There shall be a college level grievance redressal committee comprising of student adviser, two senior teachers, two staff council members (one shall be elected member) and elected representative of studentns (College Union Chairperson) as members and Principal as Chairman.

14.3. University level: The University shall form a Grievance Redressal Committee as per the existing norms.

15. A Steering Committee consisting of two syndicate members of whom one shall be a teacher, the Registrar of the University, Controller of Examinations, seven teachers from different disciplines (preferably one from each faculty), two Chairpersons of Board of Studies (one UG and 1 PG), and two Deans of Faculty shall be formed to resolve the issues, arising out of the implementation of CBCSSUG 2019. The Syndicate member who is also a teacher shall be the Convenor of the committee. The quorum of the committee shall be six and meeting of the committee shall be held at least thrice in an academic year. The resolutions of the committee will be implemented by the Vice-Chancellor in exigency and this may be ratified by the Academic Council.

16. TRANSITORY PROVISION

Notwithstanding anything contained in these Regulations, the Vice-Chancellor shall, for a period of three years from the date of coming into force of these Regulations, have the power to provide by order that these regulations shall be applied to any programme with such modifications as may be necessary.

17. REPEAL

The regulations now in force in so far as they are applicable to programmes offered by the University and to the extent they are inconsistent with these regulations are hereby repealed. In the case of any inconsistency between the existing Regulations and these Regulations relating the Choice-Based Credit Semester System in their application to any course offered in a College, the latter shall prevail.

Annexure-1

Method of Indirect Grading

Evaluation (both internal and external) is carried out using Mark system .The Grade on the basis of total internal and external marks will be indicated for each course, for each semester and for the entire programme.

Indirect Grading System in 10 -point scale is as below:

Ten Point Indirect Grading System

Percentage of Marks (Both Internal & External put together)	Grade	Interpretation	Grade point Average (G)	Range of grade points	Class
95 and above	O	Outstanding	10	9.5 -10	First Class with Distinction
85 to below 95	A+	Excellent	9	8.5 -9.49	
75 to below 85	A	Very good	8	7.5 -8.49	
65 to below 75	B+	Good	7	6.5 -7.49	First Class
55 to below 65	B	Satisfactory	6	5.5 -6.49	
45 to below 55	C	Average	5	4.5 -5.49	Second Class
35 to below 45	P	Pass	4	3.5 -4.49	Third Class
Below 35	F	Failure	0	0	Fail
Incomplete	I	Incomplete	0	0	Fail
Absent	Ab	Absent	0	0	Fail

Example – 1 SGPA Calculation

Semester I	Course Name	Grade Obtained	Grade point (G)	Credit (C)	Credit point (CXG)
XXXXXXX	XXXXXXX	A	8	4	32
XXXXXXX	XXXXXXXXXX	C	5	3	15
XXXXXXX	XXXXXXXXXX	A+	9	4	36
XXXXXXX	XXXXXXXXXX	B+	7	3	21
XXXXXXX	XXXXXXXXXX	P	4	3	12
XXXXXXX	XXXXXXXXXX	C	5	4	20

SGPA = $\frac{\text{Sum of the Credit points of all courses in a semester}}{\text{Total Credits in that semester}}$

$$\text{SGPA} = \frac{32+15+36+21+12+20}{21} = \frac{136}{21}$$

SGPA = 6.476

Percentage of marks of semester I = (SGPA/10) x 100 = 64.76 %

Note: The SGPA is corrected to three decimal points and the percentage of marks shall be approximated to two decimal points.

Example: 2

Semester II	Course Name	Grade Obtained	Grade point (G)	Credit (C)	Credit point (CXG)
XXXXXXX	XXXXXXX	A	8	4	32
XXXXXXX	XXXXXXXXXX	C	5	3	15
XXXXXXX	XXXXXXXXXX	A+	9	4	36
XXXXXXX	XXXXXXXXXX	B+	7	3	21
XXXXXX*	XXXXXXXXXX	F	0	3	0
XXXXXXX	XXXXXXXXXX	C	5	4	20

*Failed course

Note: In the event a candidate failing to secure 'P' grade in any Course in a semester, consolidation of SGPA and CGPA will be made only after obtaining 'P' grade in the failed Course in the subsequent appearance.

CGPA Calculation

$$\text{CGPA} = \frac{\text{Total Credit points obtained in six semesters}}{\text{Total Credits acquired (120)}}$$

Example

$$\text{CGPA} = 136 + 145 + 161 + 148 + 131 + 141 / 120 = 862/120$$

$$\text{CGPA} = 7.183$$

$$\text{Total percentage of marks} = (\text{CGPA}/10) * 100$$

$$\text{Total \% of marks} = (7.183/10) * 100 = 71.83$$

$$\text{CGPA of Core Courses} = \frac{\text{Total Credit points obtained for Core Courses}}{\text{Total Credits acquired for Core Courses}}$$

Similarly CGPA of Complementary courses, Open courses, English Common courses and Additional Language Common courses may be calculated and the respective percentage may be calculated. All these must be recorded in the Final Grade Card.

ANNEXURE II

Guidelines for the Evaluation of Projects

1. PROJECT EVALUATION- Regular

1. Evaluation of the Project Report shall be done under Mark System.
2. The evaluation of the project will be done at two stages :
 - a) Internal Assessment (supervising teachers will assess the project and award internal Marks)
 - b) External evaluation (external examiner appointed by the University)
 - c) Grade for the project will be awarded to candidates, combining the internal and external marks.
3. The internal to external components is to be taken in the ratio 1:4. Assessment of different components may be taken as below.

Internal (20% of total)	External (80% of Total)	
Components	Percentage of internal marks	Components
Originality	20	Relevance of the Topic, Statement of Objectives
Methodology	20	Reference/ Bibliography, Presentation, quality of Analysis/ Use of Statistical Tools.
Scheme/ Organisation of Report	30	Findings and recommendations
Viva – Voce	30	Viva – Voce

4. External Examiners will be appointed by the University from the list of VI Semester Board of Examiners in consultation with the Chairperson of the Board.
5. The Chairman of the VI semester examination should form and coordinate the evaluation teams and their work.
6. Internal Assessment should be completed 2 weeks before the last working day of VI Semester.
7. Internal Assessment marks should be published in the Department.
8. In the case of Courses with practical examination, project evaluation shall be done along with practical examinations.
9. The Chairman Board of Examinations, may at his discretion, on urgent requirements, make certain exception in the guidelines for the smooth conduct of the evaluation of project.

2. PASS CONDITIONS

- Submission of the Project Report and presence of the student for viva are compulsory for internal evaluation. No marks shall be awarded to a candidate if she/ he fails to submit the Project Report for external evaluation.
- The student should get a minimum P Grade in aggregate of External and Internal.
- There shall be no improvement chance for the Marks obtained in the Project Report.
- * In the extent of student failing to obtain a minimum of Pass Grade, the project work may be re-done and a new Internal mark may be submitted by the Parent Department. External examination may be conducted along with the subsequent batch.

Annexure-III

Question paper type 1

Scheme of Examinations:

The external QP with 80 marks and Internal examination is of 20 marks. Duration of each external examination is 2.5 Hrs. The pattern of External Examination is as given below. The students can answer all the questions in Sections A&B. But there shall be Ceiling in each section.

Section A

Short answer type carries 2 marks each - 15 questions Ceiling - 25

Section B

Paragraph/ Problem type carries 5 marks each - 8 questions Ceiling - 35

Section C

Essay type carries 10 marks (2 out of 4) 2X10=20

Question paper type 2

Scheme of Examinations:

The external QP with 60 marks and Internal examination is of 15 marks. Duration of each external examination is 2 Hrs. The pattern of External Examination is as given below. The students can answer all the questions in Sections A & B. But there shall be Ceiling in each section.

Section A

Short answer type carries 2 marks each - 12 questions Ceiling - 20

Section B

Paragraph/ Problem type carries 5 marks each - 7 questions Ceiling - 30

Section C

Essay type carries 10 marks (1 out of 2) 1X10=10

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